

June 26, 1961

Aviation Week

and Space Technology

**Super Frelon
Program Involves
Four Countries**

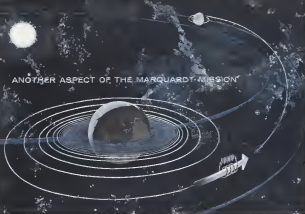
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Inverted Bomb Burst
By Patrouille de France

ANOTHER ASPECT OF THE MARQUARDT MISSION



ELECTRIC PROPULSION

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The Marquardt Corporation—long a leader in the field of propulsion—is intensively engaged in a variety of unique electric propulsion projects. An example is the electrothermal area in the Bessetop. Here the hydrogen propellant passes over an electrically heated resistance element in order to

extension in a deferral mode. The Boostjet provides reliability, long life, direct coupling to the power supply, high efficiency, simple starting cycle, and thrustability.

The Marquardt Corporation's efforts in the space propulsion and control fields serve to typify yet another aspect of the Marquardt Mission.

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AVIATION CALENDAR

MOTION:
IMPLICIT IN MATTER



Titan II unit shown in Hamilton Standard White Room for assembly and checkout. Unit is designed to pump and meter propellants to first and second missile stages at rates up to 190 gpm and pressures to 150 psig.

White room for the Titan II propellant transfer system

Development and production of equipment for handling extremely volatile missile fuels—like the propellant transfer unit for The Martin Company's Titan II—demands a contamination-free environment, controlled to within 0.3 microns. Hamilton Standard's new White Room, especially designed for building missile fuel handling systems, even surpasses the existing requirements of a hospital operating room. It provides 900 square feet of ultra-modern assembly and testing equipment. Detailed construction care and strict control procedures will maintain minimum conditions always.

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PLANTS AND LABORATORIES FROM COAST TO COAST

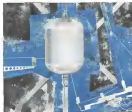
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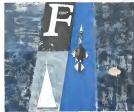
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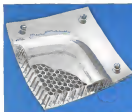
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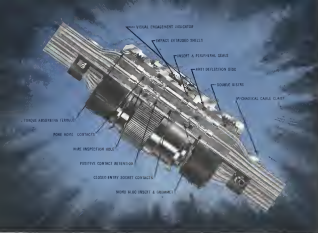
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aviation products

EDITORIAL

Comsat Decision Urgently Needed

If the United States acts boldly and energetically now, the first person to see and hear on television screens around the world could be an American President. Otherwise the matter of communication at the world's first global television show probably will be Nikita Khrushchev's (AW Aug. 8, 1960, p. 23).

Today, nearly a year after these words appeared on this page, it might seem that we have added moved bolts and misapplied. In the months that followed our admission, President Eisenhower and later President Kennedy, congressional leaders and the more important government agencies have taken steps which acknowledged the importance of a U.S. first in this dramatic use of space technology.

In industry, all of the communications companies are men who would see such a system have expressed a strong desire to see it established. The laboratories of five of these concerns already are busily engaged in related experiments.

In the aerospace industry, Boeing and General Electric are developing a mobile communications satellite, Project Advent, and Radio Corp. of America recently started work on an experimental civil communications satellite for the National Aeronautics and Space Administration. Philco is working on a delayed repeater-type satellite under Army sponsorship and companies like Collins Radio and Hughes are experimenting with communications satellite techniques using their own funds.

Lockheed and General Electric, both with considerable space technology experience, have proposed or granted new independent companies to finance with job and operate a commercial satellite system.

Given only these facts, one might conclude that the U.S. was certain to lead the communications satellite field. Actually, the entire program now is bogged down in conflict and controversy.

Within the ranks of the international communications concerns, there is such unanimous agreement that the satellite system should be jointly owned and operated by them. But there is disagreement among some of the smaller concerns over possible domination by American Telephone & Telegraph Co.

There is disagreement between the Federal Communications Commission and the Justice Department over who should share in the system ownership. The FCC favors sharing ownership to ensure international carriers, while the Justice Department urges participation be assured and other companies.

Even the lack of demonstration which previously demurred the international concerns cannot force the aerospace/communications manufacturers are seeking some AT&T's Western Electric, RCA, Communications' parent company and American Cable & Radio Corporation's parent International Telephone & Telegraph Co. all have development laboratories and manufacturing capability that are being used in the aerospace field. The Solvina division of General Telephone & Electronics Co., a domestic concern, is in a similar position.

With the sort of in-house scientific talent and production facilities, some aerospace companies are ap-
 pearing that the concern will return as active share of the hardware production for themselves, despite broad but unproven promises to the contrary and FCC's firmly expressed intention. This concern is shared by some congressional leaders and Justice Department officials.

While AT&T has acknowledged expertise in the communications/electronics field and in global services, it is a comparative newcomer in the fields of space technology and satellite design. If the company were drawn back to this new technology, rather than make full use of existing aerospace industry capability, we will squander both time and resources.

One way to speed this aerospace technology and experience into the system design would be to allow such companies to share in system ownership. But if this is the only way in which an aerospace company can gain an audience for its ideas and secure itself of an equal opportunity to bid for hardware production, then the dream of corporate self-reliance and participation and the program will bog down from sheer inertia of snail's pace and the pressure of corporate self-interest.

It should be possible to provide realistic safeguards to ensure equality for all ideas and build in an open market place, without requiring each to share in ownership.

President Kennedy has now asked the National Aeronautics and Space Council to study these complex questions, which extend beyond the authority of any one department or agency, and recommend a national policy which gives highest priority to the public interest. From that study, we believe the following principles should emerge:

• A U.S. first in communications satellites is a national objective that should override competitive interests of individual companies.

• The technology is readily available now within the U.S. is capable to be first.

• The system will be a showcase for American technology and industry and should therefore reflect the best engineering thinking that can be brought to bear. Regardless of who owns the system, its international impact is too great to handicap it with design concepts of only a single or a handful of companies. It should be the product of a wide spectrum of American industry.

• The system must be compatible with the extensive communications facilities of the existing carrier, which means the most participants actively in system design.

• Satellite ownership should be provided so that no aerospace company feels obligated to invest in the communications satellite system using capital needed for other purposes, thereby to insure that of an equitable opportunity to have its ideas and beliefs receive fair consideration.

If the National Aeronautics and Space Council can produce a timely and sound decision to push the communications satellite program with maximum possible speed backed by the best technology, it will have taken a major step in establishing its leadership in the face of the public skepticism that has followed it since its inception several years ago.

—Robert Hietz

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One man, working from the head side only, can install up to 36 SLEEVE-LOCKS a minute—a rate 56% faster than with most comparable fasteners. SLEEVE-LOCK is simple... comes preassembled... fits standard holes... drives with standard power tools fitted with inexpensive adapters.

SLEEVE-LOCK performance extends that of NAS solid shear bolts: heat treated to 190,000 psi, permitting size-for-size substitution. In repair work, this frequently allows quick replacement of conventional nut-and-bolt combinations that would present major dismantling and reassembly problems.



Inserting: Preassembled SLEEVE-LOCK is inserted from one side of work. Can also be pre-inserted in an underside hole if desired... see next two sections.



Driving: Simple adapter in power drive holds sleeve stationary while turning core bolt, thus driving nut in or out. Sleeve-Lock does not have to be disassembled with tools.



Releasing: After breaking lock by momentarily reversing drive, screw opened by an 18° torque return at core hole. Sleeve-Lock does not have to be disassembled with tools.



Core bolt: in easily withdrawn by gripping bar with barrel-handle assembly. Bolt can then be pulled from hole with pin or with an Easy-Out type tool.

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WHO'S WHERE

In the Front Office

Jose L. Jerez still becomes vice president general manager of the Santa Monica Division of Douglas Aircraft Company, Inc., working for Lee A. Carter, assuming to accept a special assignment with the company. **James W. Row** will succeed Mr. Jerez as general manager of the El Segundo Division. **James H. Godegar**, chairman of the board's newly formed space committee, Thompson Research Wobbling, Inc., Cleveland, Ohio, **Frank G. Hubbard**, secretary, will be vice president.

J. R. Rye, a vice president, Ryle Aircraft Corp., Clarksville, Md., Mr. Rye continues to manage all of the company's operations in the state of Maryland.

Ray J. Eversole, vice president and in charge of the product line for Santa Monica.

Charles M. Mooney vice president of 5 Division, Group, International Telephone and Telegraph Corp., New York, N.Y.

Dr. Howard H. Adams, a director, MacLean Inc., Dallas, Ohio. Dr. Adams is director of Harvard Corporation's research and professor of applied mathematics at Harvard University.

Edwin D. Campbell, vice president and general manager, Laboratory for Electronics Inc., Boston, Mass., **David A. Shaw**, vice president, New York, N.Y.

T. A. Buchanan, vice president and general manager, **J. E. Neumann**, vice president and general manager, Conkco Factors Corp., Boston, N.Y.

Robert C. Dineen, a vice president, will be in charge of the division of 5 Division, Inc., in charge of operations at Short Space, Inc.

Mr. Geo. John A. Butler, deputy commander, Air Operations, **Mr. William R. Butler**, deputy commander, Air Operations, **Mr. William R. Butler**, deputy commander, Air Operations, **Mr. William R. Butler**, deputy commander, Air Operations.

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(Continued on page 114)

INDUSTRY OBSERVER

Armstrong-Rohlfing, General Electric and Pratt & Whitney have made various, similar proposals to National Aeronautics and Space Administration for development of a 5-million Btu thrust liquid oxygen liquid hydrogen rocket engine.

NASA Marshall Space Flight Center may award a \$110,000 contract for a 110,000-horsepower study for a Nova vehicle design launch facility by June 30 in order to develop it with Ford 360 launch (AW June 15, p. 32). This effort appears to be a precursor to an orbital land test, such as Florida's Everglades, might be considered as an alternative.

Immediate assignment of an Air Force test pilot to the North American 378 light jet program has been announced as the result of a contract awarded by the Air Force to the North American 378 light jet program. The test pilot will be assigned to the North American 378 light jet program. The test pilot will be assigned to the North American 378 light jet program.

Recent test firing of a United Technology Corp. solid rocket motor (ASTM) resulted in a test rate of about 0.95 and propellant specific impulse of approximately 270. Test unit for the experimental project had about 500 lb. of propellant, a rubber-type insulator and glass fiber-reinforced case.

New Bureau of Ships is expected to award three parallel study contracts for software data processing equipment and display system for monitoring and controlling surface. Systems would be capable of accepting a variety of inputs and handling detection, acquisition, tracking and decision making.

General Electric's Flight Propulsion Division is working on a family of highly advanced engines based on component design developments under its X-70 program. Flight engines both solid and liquid propellant engines for use over a wide range of Mach numbers and probably in need of a one-stage-to-orbit vehicle such as USAF's proposed Aerospace Plane.

NASA modified focus use of a radioisotope thermoelectric generator for both power and heat on the hot face of an X-ray projected source for both power and heat on the hot face of an X-ray projected source for both power and heat on the hot face of an X-ray projected source.

Exhibit is a new research and development project aimed at developing equipment for ocean surveillance from aircraft. It includes projects for both active and passive systems, a passive system and an active system.

Air Force has asked for \$17 million in FY-1962 for procurement of an AL-119A ground-based electromagnetic reconnaissance system which is a form part of the AL-119A ground-based electromagnetic reconnaissance system.

Model of NASA's SeaWiFS satellite will collect data in a space vehicle electric power system is scheduled to be flown in about a year in an Apollo D-4 payload. Test flight will be made from Wallops Island, Va.

Latest Air Force estimate of the cost of developing, fabricating and installing the Strategic Air Command Control System 803, including some 100,000 man-hours of work, is \$157.5 million, a substantial increase over last year's estimate of \$127.9 million. Fiscal 1962 request for \$157.5 million provides for hardware control system at SAC headquarters and at March AFB, Calif.

SeaWiFS program project activities have been moved out of the lab at Long Beach, Calif., after the initial work presented killed a large number of SeaWiFS and other long-range and short-range work out of view. The project activities have been moved out of the lab at Long Beach, Calif., after the initial work presented killed a large number of SeaWiFS and other long-range and short-range work out of view.

In the minds of GCR researchers, the moon is always up there, big and challenging. They see space stations, too. And Venus and Mars—and further. These visions are linked with the exciting realities of their work in solid propellants and propulsion systems: multi-million pound thrust segmented boosters; nitroplast and rubber-base propellants; hybrid rockets; and much more. GCR researchers use the most advanced tools available—including the new million-dollar lab shown below. And they can see their ideas brought to life and put to the test on the spot in GCR's modern manufacturing and testing facilities.

GRAND CENTRAL ROCKET COMPANY

REDLANDS, CALIFORNIA



THE MOON
NEVER SETS
IN REDLANDS,
CALIFORNIA

Washington Roundup

Dyna-Soar Hopes

Air Force's hopes for expansion of the Dyna-Soar boost glide project are growing. Chief opposition to making it a weapons system program rather than a research and development effort has come in the recent action by Dr. Eugene S. Smith, former director of research and engineering for Defense Department, from USAF Under Secretary, Joseph Clark, and from the National Aeronautics and Space Administration, USAF's technical partner in the project.

Clark has now left the Pentagon. The attitude of his successor, Dr. Harold Bloomer, is not clear yet. Clark, a holdover from the previous administration, has helped Air Force through the transition stage and some observers believe he may be leaving since NASA's objections are not strong enough that they couldn't be overcome if Defense decides a weapon system is the better approach.

In addition, the new USAF Chief of Staff, Gen. Curtis LeMay, is understood to favor a more cautious approach and Lt. Gen. Bernard A. Schriever, whose Air Force Systems Command has the development responsibility for Dyna-Soar, has always favored a more conservative, rapid program pace (see p. 78).

Ward for Gen. Chet Cook (USAF, ret.) is active as president of the Aerospace Industries Assoc., shortly AIA will abandon its past practice of hiring a top executive second Navy or Air Force officer and hiring as a new president with considerable experience in the aerospace industry.

When Charles Hiltz, Defense Department comptroller, set out to determine the estimated costs of each current and proposed military program he indicated it could be done without substantially increasing the size of his office.

These are no complaints in the Pentagon that his efforts have already acquired longer hours and more require additional help both in the computerized effects of the data services and in the plans to which the comptroller must go for their information. Hiltz and a number of his assistants are working 11-16 days.

Supersonic Study

Task group to study the military requirements for a supersonic transport has been formed by the Office of Defense Research and Engineering. It will look at possible mission, structure, and engines, and it hopes to include representatives from other government units including the Federal Aviation Agency.

Private pilots who are being squeezed out of landing fields are finding a champion in FAA Administrator Nagels Halsey. He calls them "criticisms of the air" and has pledged to let in to get comments and even states together on building common grounds for them. Following a questionnaire survey of 250,000 pilots, Halsey has held an "on shore meetings" with private pilots to see how FAA can help them.

Smooth political house work is coming the National Aeronautics and Space Council a good reception on Capitol Hill. The council, headed by Vice President Lyndon Johnson, got off the \$728,000 it asked for Fiscal 1962 from the House and is not expected in the Senate.

Executive Secretary Edward C. Wright has pledged to keep the staff small and use science advisers already in government rather than hire new consultants. He intends and President Kennedy's science adviser for national space goals, he will continue to get support for it by meeting with key congressional Democrats and Republicans at each step as the package together.

Yo-Yo Returns

Navy's idea for a single-pass reconnaissance satellite, which occurred little attention when it was first proposed in Project Yo-Yo more than a year ago now, has been much into a project in Defense's Advanced Research Projects Agency. At one time the plan was to launch the Yo-Yo satellite with the Sea Scout—a vehicle using Polaris solid-fuel engines topped by NASA Scout upper stages. However Air Force may be assigned the job instead of the Navy, which could change the booster. Navy's Earth Spring satellite "space men" concept does a recurring session attention.

Weather forecasting, with special emphasis on the potential of meteorological satellites, will be looked into soon by the House space committee. Forecasting was studied by the Weather Bureau, Federal Aviation Agency, NASA, the military services and other agencies. Senate appropriations committees, alarmed that duplication when it arrived the FAA's budget, is deferring FAA and it has a check order way that should lead to a single, integrated national system weather system in two years.

Highways, liquid propellant upper stage that will be developed for use on the Titan II in a booster vehicle for Advent satellite launching is included Project Chance. Because USAF Under Secretary, Joseph Clark, has given strong support to the proposal, it also is referred to as "Clark's Chance."

—Washington Staff

Agreement Reached on USAF Solids Role

Defense-NASA pact formally marks Air Force return to major booster program, opens door for expansion.

By Edward R. Kolman

Washington—Defense Department and National Aeronautics and Space Administration reached an agreement last week which makes formal the return of the Air Force to the national space booster development program and opens the door for a possible major expansion of the USAF role in the U.S. space effort.

The agreement gave the Air Force technical responsibility for development of the solid Nova, which must be done to NASA specifications. USAF is not limited to NASA requirements, however, and is expected to add its own launch to the large solid rocket development program.

How much of a wedge this will give the Air Force regarding its space program depends largely on:

- Success of the large solid rocket program, compared with the success and timing of the NASA Roadrunner 1.5 million lb thrust F-1 liquid engine.
- Assessment of additional missions for the large solid, such as the Titan-Star weapon system which now is expected to be less or near 25,000 lb.

Although the liquid and solid Nova developments are called separate programs they are expected to become increasingly competitive within the next few years until a decision is reached on which program first to go for the Nova booster (the solid is chosen, the Air Force will provide engines for NASA for its Apollo-oriented lunar landing program).

Most important to the Air Force is

the fact that Nova is its first opportunity since it lost its booster program to NASA in 1970 to get into development of a program in a form which does not have a specific military mission. Records expanded role of the USAF Systems Command, increases the chances that the new launch vehicles will be given military missions. Systems Command is growing from 45,000 to about 75,000 personnel; it has been given procurement responsibilities. Its mission and growth and its commander Lt. Gen. Ronald A. Schriener, is being promoted to four-star rank.

Nova's Value

Solid Nova booster made to be designed to launch at least 142,000 lb to compete seriously, then gives the solid rocket industry the opportunity to sub-

stantiate claims of the high potential of the propellant (AW Mar. 20, p. 10). The program is expected to be chosen for early development phase of the large solid rocket.

Deputy Defense Secretary Russell L. Gelpi recently told Congress that the liquidated Nova launch vehicle can be made by 1984 (AW June 12, p. 15) and Defense Secretary Robert McNamara has predicted large solid rocket development could grow into a \$400 million program (see box).

Possible C-3 Role

Solid propellant proponents see the solid Nova as a useful one shot for the liquid rocket Nova but also for the much heavier Saturn C-3 (AW June 19, p. 20). Both the liquid Nova and C-3 are based on the Roadrunner F-1 powered first stage and one solid add-on. Indicators that of a decision on liquid and solid has not already been reached, the solid Nova booster has a chance to be the C-3 booster.

Among the latest requirements NASA is considering an expansion to the Air Force for the solid Nova motor is:

- Maximum dynamic pressure of 1,000 psi, which Robert Wood of NASA's solid rocket office feels the current design point since the vehicle must be built for an abort at maximum dynamic pressure.

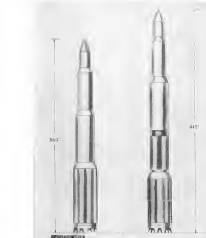
- Maximum lift-off mass of fig. A, maximum dynamic pressure force of under 1,000 psi will keep lift-off forces under fig.

- Burning time of 85-100 sec., a parameter which governs dynamic pressure (also increased burning time decreases thrust losses). One industry representative claims that the large booster could have a 120-sec. burning cycle.
- Specific impulse and mass fraction ratio are not specified, but current technology is believed to be sufficient in these areas.

Wood said he does not intend any new technology is needed for the solid Nova except in developing an attitude control. "Acquet General" claims he for the Air Force indicated that studies can be carried out special to accommodate large motors and the problems of liquid-erosion densities as the use of the motor increases he said.

William Green chief of NASV's solid rocket programs said the agency is actively considering these solid Nova configurations:

- Three-stage, generally based at 150 feet because it would be simpler to design. It would consist of an eight motor cluster of 1.25-million-lb segments at the booster base. Each segment would be about 13 ft in diameter



PRELIMINARY CONFIGURATIONS of the solid Nova include one two-stage vehicle with solid first and second stages and one with three stages. Top two stages are built with liquid hydrogels liquid oxygen engine clusters. Vehicle is a possible development in the liquid F-1 motor program and it will be designed to launch more than 142,000 lb to major vehicles for the Apollo-oriented lunar mission. Some serious work on these vehicles are not needed at this time. Three-stage version is shown at left.

and 110-ft high. Total booster stage would weigh 10 million lb and lift-off thrust would be 20 million lb. Second and third stages would be liquid hydrogels oxygen cluster vehicles of the Roadrunner F-2 which develops 208,000-lb thrust.

- Four-stage, a booster cluster of seven segments, 15 ft in diameter and about 10-ft high. Second stage would be a cluster of three or four solid motors and the two upper stages would be the same as the three-stage configuration.

Another concept, which has not been fully studied, is a two-stage configuration. The booster could consist of six 10-ft diameter segments topped around a hydrogels oxygen engine. Second stage would be another hydrogels oxygen engine.

Maximum diameter of any of the configurations is 45 ft. Colson said, which is about 3 ft less than the diameter of a liquid Nova cluster of eight F-1 engines (AW June 19, p. 12).

Boat design requirements are preliminary and could change as called from a month long study by NASA's scientific and technical advice from staff of the solid rocket command in the center.

One major difficulty in the solid Nova program is the cost and how required to develop and build launch facilities. Colson would like to see construction started immediately on a single complex which could handle either solid or liquid Nova vehicles even though design work would be completed.

New Science Office Urged in White House

Washington—President Kennedy was asked last week in a Senate staff report to establish a White House Office of Science and Technology to help plan the nation's scientific effort.

Charles Henry M. Jackson (D-Wash.), endorsing the report prepared by the staff of his Senate Government Operations National Labor-Nuclear Subcommittee and President Kennedy's appointment of White House science advisors was a "forward step" but the time has come to build upon that advance.

The report recommended making permanent the post of special assistant to the President for science and technology and the President's Science Advisory Committee.

The special assistant to the President for science and technology would lead the new Office of Science and Technology. The office, according to the report, would be "a staff unit helping the President coordinate and put together science and technology." The director of the office should have two deputies, the report said.

Nimbus TV to Have Resolution of 0.1 Mi.

Cape Canaveral—Three video cameras in the reconnaissance Nimbus weather satellite, planned well over a large area of the earth's surface, with a resolution of 0.1 mi, according to Robert Golden of Goddard Space Flight Center.

The 600-lb Nimbus package is scheduled to be launched next year by a Thor-Agena B stage, a reusable 600-mi polar orbit from the Pacific Missile Range. Golden told the Cosmos, TV, division of the Institute of Radio Engineers that the video pictures will have "the capability of resolving the system from infrared to infrared during the night, and the infrared camera will have a 1-mi resolution.

The satellite will make 17 orbits daily, and will be photographed by the primary stations in Fairbanks, Alaska, once every day. The system will be designed to store 48 pictures per orbit. A gas system will be used for path synchronization to provide continuous coverage of the entire lower half of the ground. Mission scenarios will check the orbital alignment, and continuous will be made by station jets.

Current system for 114-in-high Nimbus also contains a meteorological camera which represents a major cost to the earth launch budget, and a low-resolution infrared scanner to observe day and night cloud patterns.

Large Solid Booster to Cost \$500 Million

Washington—Total development cost of Air Force's new large solid rocket booster program scheduled to be initiated in 1962 with \$60 million in preliminary studies and \$400 million in development, according to a NASA spokesman.

McNair said the House appropriations committee that four contractors probably will be invited to submit proposals for the booster, with one selected for "preliminary work."

After the preliminary work is completed, he said the field will be narrowed to one contractor. McNamara's testimony was released last week.

Mr. Gold, Robert J. McNamara's USAF budget director, said that a program applying the large solid booster to vehicles for civilian space use would bring the cost to \$1.77 billion. Military applications have been categorized in USAF's Project Phoenix study (AW May 27, p. 50).

Depending on the number of states it is to be launched," Gen. Friedman commented, "programs could bring it beyond that" \$2 billion figure. He said that for space systems with the solid propellant booster, Air Force technical experts "would go toward liquid propellant."

The President's report to initiate the program now pending in Congress includes \$50 million for the booster development, plus \$12 million for support facilities. The first stage for the booster vehicle, Gen. Friedman noted, would have to have a diameter of 25 to 30 in. since the booster's nose level would actually place within this size.

Gen. Friedman also declared that the Air Force should not initiate work on its program for an improved rapid stage rocket for the Titan II launch vehicle with Aerospace Corp. (AW June 12, p. 32). USAF studies show that there are about five possible approaches to the program he said. The President has requested a single master budget of \$37 million for fiscal 1962 to initiate it.

U.S., Soviets Move Toward Nuclear Tests

Washington—Resumption of nuclear weapon tests by the two great nuclear powers appeared certain last week as pressure for testing mounted in the U. S. and Soviet Press. The Kremlin, it was noted, had begun tests "immediately" if the U. S. ends its three-year voluntary moratorium.

President Kennedy has warned Russia that the U. S. might be forced to resume tests if agreement on an international ban is not reached soon. Premier Khrushchev, appearing in his native hometown, greeted the members of a Kremlin meeting marking the 25th anniversary of the October invasion of Russia, and "many new devices have been worked out that require practical tests." He said other weapons need improving and said of Russia failed to test while the nuclear powers do, "we would crumble in the delicate ability of our own country."

U. S. opponents—chiefly those of the military services and the Joint Congressional Atomic Energy Commission—say the same cannot be said. The U. S. could resume tests and still the further point that Russia may now be testing is moot, since no detection system is designed.

Sen. Henry M. Jackson (D-Wash.), commenting after his Subcommittee on military applications of atomic energy held the Joint Chiefs of Staff in secret

last week and that Russia advanced its military technology "immensely" in an intensive series of tests just before both sides agreed to stop testing last week. He said the Russian "may be ahead" in some areas of nuclear weapons.

Military analysts took their arguments for a test resumption.

Development work has resulted in dramatic reduction in the size of weapons, or, conversely, in greatly increased yields but no testing has been done to prove them. The "airborne weapons" in which the capability of U. S. technology. For instance, a weapon weighing 100 lb. has been designed to yield an equivalent of 100 kilotons of TNT, or five times as much as the Hiroshima bomb of World War II, and one weighing 600 lb. has been designed which can produce a one megaton yield.

Methods of detecting tests underground or outside the atmosphere are still in embryonic stages. Seismographic techniques are not susceptible to deception. "The neutron, or 'clean' bomb," will remain a fiction, until actually tested. It is based on a relatively high order of fusion reaction with lower production of radioactive byproducts.

Even if nuclear disarmament were agreed upon, weapons components

could be hidden by other parts so that no inspection team could find them.

The "exclusive nuclear club" is no longer a reality, and Russia is developing its independent war and Red China reported to explode its own weapons soon. Nuclear weapons will probably go into the hands of allies at both Russia and the U. S.

They also argue that from a military standpoint, nothing should interfere with keeping the U. S. nuclear deterrent posture at a high level. Without it, the U. S. position in world politics would be weakened.

This posture, three officials maintain, cannot rest on an agreement with an arms-control opponent, and the Soviet Union cannot be trusted, they feel.

Inspection and Detection

Practical control of nuclear weapons depends on inspection and detection. Their point out that inspection of a country cannot be deception would be the chief of nuclear weapons could be hidden in loaded gun clusters, in mines, among railroad cars in an industrial facility, among the gold bars of P. Kios, or simply buried in obscure places.

Seismographic techniques are possible. By varying the size and shape of the detector in which an underground test is to be performed, the explosion can be made to resemble natural earth shocks. Placing a network of such detectors would avoid transmission of the tremors in the earth's outer shell.

For testing outside the atmosphere, detection would be a relatively easy task. The U. S. already has an orbital detection program in Project Vela Vela (Hoh) in the portion of that project devoted to space detection (AWN No. 14, p. 10).

The first stage in this program has featured 24-ft. parabolic packages (used in ICBM's in test flights). Mutual radiation has been measured in this series at altitudes up to 300,000 mi.

Package from the Air Force that Soviet rockets are designed to go to altitudes ranging between 3,000 miles and 30,000 miles on "These flights are planned to last until 1961. They are of limited value, however, since high-altitude nuclear bursts are prohibited by part of the maintenance and no data can be obtained on nuclear explosions.

For detection components in deeper space, satellites weighing 75 lb. are to be launched into stable elliptical orbits by launch vehicles used in Atlas D first stage and Agena B second stage, with apogees of 90,000 miles and perigees of 150 miles on. They will observe directly background radia-

tion observations, with no nuclear or plasma measurements possible.

On the Vela detection development program, the agreement is observed that Russia could keep in touch with U. S. technology, then, it accused of capitalizing nuclear weapons, especially those which have testing. Their knowledge of detection techniques is thus limited. It is impossible to prove a weapon has been exploded. The military services claim resumption of testing would result in these advantages.

• Much less to be learned on the fusion or hydrogen, bomb. Its energy involves an escape of hydrogen, these explosive tests can be made much "dumber" through experimentation. Thus, relatively less contamination outside would be released with relatively more material going into energy. This is how the approach to the scientific status bomb.

• Increased yield in fusion bombs would permit carrying out weapons in B-52, B-58, and B-70 bombers and would put more power into the war heads of the Atlas, Titan and Minuteman ICBM's and the Polaris fleet ballistic missile.

• Greater reduction in size of tested nuclear weapons which are fusion bombs based on cesium 238 and plutonium, increasing their versatility. These weapons are basically "dirty," or highly contaminating, after firing. Such weapons without a conflict, growing into an almost nuclear war. Supporters of the Army's Pershing missile concept and the Air Force tactical nuclear force support agreement, however, say that these tests can be made and the consequences of nuclear explosion.

Sikorsky Designs High-Speed HSS-2

Sikorsky Aircraft has completed a preliminary design study of a high-performance helicopter based on the dynamic system of the HH-24 and scheduled to be capable of carrying a payload at a speed of 200 mph.

Conducting research with U. S. Army Transportation Research Command (TRC) and Sikorsky, the company is developing a conventional four-blade rotor of 120-ft. and a maximum speed of 200 mph, coupled with satisfactory range and handling characteristics.

Sikorsky says the design objectives have been met or exceeded, and cites a 7,400-mph. first stage and a 275-mph. top speed as examples. "Payload payload can be increased to 45,000 lb. at a speed of 200 mph, and more than 7,000 lb. can be lifted by raising that cruise speed to 275 mph," said substantially less than such capacity designs.

New design features a low-drag fuselage and fixed rotor hub and pylon. All load may now be automatically released. Fixed vertical and horizontal stabilizer fins with rotors and drive are set for control in the high-speed flight regime.

Powerplant will include a four-cylinder, 170-hp shaft engine, and as the Navy's HSS-2 and the commercial S-61. Working capacity is planned around 20 tons.

Company says that performance estimates were based on improved methods, methods in three areas: reduction of rotor performance in flight; means to avoid the application of loading theory, advanced work on blade vibration; and building selection of the best compromise between these and performance. The lightest possible aircraft with characteristics achieved much more on light structures.

Berlin Corridor Control

Germany—Control of an corridor, communication and other passage links of all roads leading into Berlin, plus the possible closure of Tempelhof airport, would follow any power treaty between East and West Germany, according to Walter Ulbricht, chairman of the East German Council of State.

Speaking before an East Berlin assembly, Ulbricht said Tempelhof should be closed to all traffic because it is the only airport in East Berlin's Schönefeld airport. Noting that Tempelhof is located in the heart of the West Berlin, he added:

"It is in the interest of the West Berlin population to eliminate the zone from around the city and the danger of a crash in landing areas such as the one in Tempelhof (U. S.AT 1-151) on so long ago."

Ulbricht Tempelhof would only serve out on its own area in agreement is reached on the organization of all air traffic to and from Berlin in general and on its safety issues in particular. "We only see the closing of the airport in connection with representations of the acceptable state and its working this suggestion."

Asked whether East Germany demands the control of all air traffic into Berlin, Ulbricht said: "We are not interested in the control of all passages into Berlin, but in the control of the airport."

A passage into an airport with international procedure and the presence of individual nations is not a matter of any description is concerned.

Whether people enter one freeway by land, water or air, they are all subject to our control and our law."

He added that, with Schönefeld the only Berlin movement airport, "necessities would then be controlled by us and whoever should then would be forced there."

In answer to a question concerning the West's probable reaction to such action, he said the Communist government has "examined this question, and so do not believe that Western powers would risk any act of aggression against us."

Concerning the political implications of the various weapons, some military officials say that the tactical nuclear weapons in a single, a follow-up, that the current use of nuclear weapons without a conflict, growing into an almost nuclear war. Supporters of the Army's Pershing missile concept and the Air Force tactical nuclear force support agreement, however, say that these tests can be made and the consequences of nuclear explosion.

On the accuracy for developing facilities of 100 megatons or more, the

giving officials comment that any state against China would be directed at population more than industrial capability. Thus the "biggest" and "biggest" bombs are not only population, but also, producing more radiation and heat than explosive force.

In the case of Russia, however, which population and industry is more concentrated, the bombs would be smaller and directed at industrial targets, rather than large areas.

Targuing of intercontinental ballistic missiles has suggested the concept with lighter nuclear and payload. Missiles to strike while the Titan II shuttle launch vehicle with a larger range and heavier payload will be used of land sites further into enemy territories.

Skepticism Expressed On Bomb's Feasibility

Washington—There is considerable skepticism among scientists in the Defense Department over the feasibility of the Air Force Project Bambi concept (AWN June 1, p. 11) of using nuclear launched from satellites to obstruct enemy battle in North Vietnam, South Vietnam, according to Assistant Secretary of Defense John H. Rohrer, deputy director of defense research and engineering.

Despite his reservation, Defense Department officials in a circular last week have ordered an ICBM defense study, which shows any promise of success. Rohrer said the National Research Club last week.

New Dyna-Solar Launch Vehicles Studied

Washington—Air Force and its Dyna-Solar contractors have completed studies of two different rocket vehicles that could be used to boost the second stages of the globe into orbit under Step 2A and then from orbit into a weapon system with an orbital operational capability under a proposed Step 2B.

Step 1 tests cover only orbital launch flights. Depending on their feasibility test, USAF would seek approval for Step 2, which calls for a reusable weapon system much larger and heavier than the research globe and requiring an even larger launch.

As Peter Systems Command's Space Systems Division will turn its studies over to Strategic Studies Command. The Boeing Co. prime contractor for the globe, also has studied the launch vehicles.

- Martin, Titan II made with solid rocket motors mounted the sides of the first stage. Solid rockets would serve as the first stage. Liquid-fueled Titan engines would be ignited in the air.
- First stage of the Titan II with a new high-pressure upper stage adapted from the Saturn S-V stage, which can liquid-fueled.
- First stage of the Titan II with a new upper stage based on the 200,000-lb. third stage booster J2 engine, which will power the Saturn S-V stage.
- Combination of the Saturn S-II and S-V stages.
- First stage of the Saturn G-2 vehicle, which includes the S-4, S-V and S-V stages.

The Saturn G-2 is expected to be derived by Systems Command because it provides a greater weightlifting margin than the other vehicles studied. Since the mission still is remote to launch the Dyna-Solar orbit from a research program to a full-fledged weapon system program, this margin means more greater importance.

Under proposed operations of the program, a battery version of the globe would be flown in early to early in 1962 or early in 1961. Step 3, which is the sub-orbital flight phase, probably will include five vehicles.

Delta Vehicle's Role Expanded; More Tiros, Relay Flights Added

Washington—National Aeronautics and Space Administration has substantially expanded the launch vehicle role of the Douglas Delta as it has increased in order to at least 13 vehicles, with the possibility that even more may be purchased.

Original plan was to consider Delta an interim vehicle and keep the order to 12 (NAV July 4 1966 p 31). The Fiscal 1961 budget increased the number to 15 to accommodate three Relay flights, and the Fiscal 1962 budget added eight more vehicles for Tiros and Relay satellite missions.

Reasons for the added order are to continue to keep Tiros weather satellites operating on orbit until the second generation Nimbus is ready for launch, and to push the communications satellite program. The eight additional Deltas will provide five Tiros, and backup vehicles for Tiros and three for Relay flights.

Using propulsion stages with long fuel storage, Delta is designed to fly well on three or six hr. first flight. First stage is a modified Douglas Titan, second stage a modified Aerojet Van guard liquid rocket second stage and third stage is a modified Vanguard Hercules Altigen Ballistic Laboratory

254 third stage solid motor. Douglas-designed flight controls also has performed well in placing its satellites in intermediate orbits (AV Sept 12 p 61).

Only failure in the Delta program was the first launch, May 13 1960, as an attempt to place an Echo passive communications satellite in a 1,600 mi. orbit. Second stage attitude control system apparently failed, and the third stage did not receive an ignition signal.

Repeat of the Echo experiment, Aug. 27, was successful, with satellite in orbit of 343 1,619 mi. The 100 lb. sphere is still in orbit, with solar power and drag affecting the orbit. Most recent orbit apogee puts the sphere at a 1,551 mi. apogee and 675 mi. perigee.

Third Delta launch Nov. 28 placed Tiros II at a 387-451 mi. orbit. Orbit now is 378-461 mi.

Fourth launch May 25 was the 10 lb. Tiros III satellite, which is a meteorological probe which went to a 112-590 mi. orbit.

Five launches have been made for these Delta vehicles.

• No. 5, to place the 280-lb. Tiros III satellite in a 400 mi. circular orbit

Flight is scheduled for next month. • No. 6, to orbit the 820-lb. S-6 emergency satellite in an apogee of 16,000 mi. and a perigee of 750 mi. Launch is scheduled in late fourth quarter of this year. Mission will be repeated with vehicle No. 12 during the second quarter of 1967.

• No. 7, to place the 300-lb. S-6 solar observation satellite in orbit during the fourth quarter of this year. Vehicle No. 8 is a backup, and vehicle No. 11 is a mission repeat during the second quarter of 1967.

• No. 9, to launch the 370-lb. S-6 solar observation satellite with solar apogee and perigee of 125 mi. perigee. Launch is scheduled during the fourth quarter of this year.

• No. 10, to launch Tiros IV, with the same mission as Tiros III.

• No. 11, to launch 100-lb. S-6 active communications satellite in 1,500 mi. circular orbit, during the last half of 1967. Vehicle No. 13 is a Relay backup.

Discoverer XXV Retrieved From Orbit

Los Angeles—Discoverer XXV's 100-lb. communications capsule was successfully retrieved last week from the Pacific Ocean after reentering as a polar orbit for more than two days.

The 100-lb. Agena II second stage spent 53 years in a 20-mile orbit with an apogee of 250 mi. and a perigee of 146 mi.

Discoverer XXCV, weighing in excess of 100,000 lb., was launched from Vandenberg Air Force Base on Oct. 13 PST June 15. Re-entry was commenced at 6:00 p.m. PST June 18.

Actual retrieval failed when the capsule missed the drop net, landing instead on the desert. As the capsule was lowered to the ocean, it was damaged, caused to sink during impact from SC-54 which was guided to the area of the capsule by an aerial infrared Fairchild G-619. The parachutes bailed the capsule about a 20-mile high, still dropped with them and scattered on the beach. The capsule was damaged and its contents were lost. The capsule was in the water to take them aboard at 10:00 a.m. PST June 19.

About the capsule were a number of electronic components including three Geiger tubes, an air and ozone-measuring device, glass plate and common metal oxides—gold, barium, zinc, titanium, chromium, magnesium, nickel and platinum. Also aboard the Agena II were devices to measure and measure microcosmic impacts.

This was the 17th Discoverer vehicle to achieve polar orbit and the fifth communications capsule to be retrieved. No attempt was made to recover the contents of the orbiting Discoverer. Eight failed to achieve orbit.

Kennedy Asks Commercial Satellite Study

By Philip J. Klein

Washington—President Kennedy has asked the National Aeronautics and Space Council to study the feasibility of developing a commercial communications satellite system and to recommend a national policy on the space system.

President Kennedy asked the space council to give "the highest priority to the public interest" in reaching this decision. The need for White House intervention has become increasingly apparent as the controversy grows hotter and more complex in recent weeks (AV Aug. 17 p 14).

Edward White, Space Council executive secretary, met twice last week with representatives of the Federal Communications Commission, Justice and State departments, National Aeronautics and Space Administration, Dept. of Civil and Defense Mobilization and the President's Science Advisory Committee to discuss the problem.

The issue followed strong expressions of concern over possible American technological superiority in the development of a commercial satellite system from officials of the Justice Department and FCC is increasing before the House Anti-trust Subcommittee. The mounting concern centers on the question of whether AT&T can or ought to dominate the satellite system configuration and whether the company's manufacturing subsidiary, Western Electric, would get the lion's share of hardware production.

Sharp Comments

Sharply worded language used in a barrage of comments and rebuttals, filed last week with the FCC by AT&T, the National Aeronautics and Space Council, and Lockheed and others, raised the high stakes involved.

At House Anti-trust Subcommittee hearings, the question of whether satellite ownership should be limited to communications carriers came in second place in FCC's First Report, or should be opened to scrapyard and communications manufacturers, and how such a restriction should be enforced, drew three times more lay commentary.

• American Attorney General Lee Harvey, chief of the Anti-trust Division and his department believe "it would be difficult to make a distinction between all manufacturers to sell to the system if one manufacturer had an ownership participation and other manufacturers did not."

The Justice Department claim about even more strength in AT&T's plan because it could "isolate

the receiver and equipment for research and development." Lovinger said.

• FCC Chairman Newton N. Minow said "We are not going to be in a position to do a long-term study to explore the possibilities of a commercial satellite system as long as we give our own country any domination of the post satellite system." Minow said the commission, "in my judgment, would not go along with any system where the extent of ownership by each participant is based on its size, because we would signal this in giving the largest our most active position."

In a statement filed with FCC on June 19, last day after Minow's testimony, AT&T said that it believed that ownership sharing based on size "is the only practical principle for division of capital contributions between private agencies and the U. S. carrier in a government-owned or controlled system of satellite sharing among the U. S. carriers. AT&T emphasized that in view of its flexible service, the company had prepared a similar arrangement according to size plan. Minow emphasized that serious problems surfaced if a system could ship more than one satellite to other than communications carriers. "If even one of them [scrapyard and communications manufacturers] wants in, we will share ownership, and we cannot be happy in having one system, and we cannot not carry any company differently than another."

GE's Communication Satellites May 29 pointed to FCC for consideration of its First Report and that 30% of initial ownership in the joint venture be allocated to the companies that filed in FCC's commercial communications satellite Dec. 1962, including a device to share ownership. AT&T said that the company 30% for others who might subsequently desire to participate including smaller business units and the general public. This suggested to some observers that under GE's plan, all other companies who would be eligible to join the carrier in 70% are not ownership would be GE and Lockheed, the main aerospace companies to

file a proposal in the FCC case. However, a Communication Satellite official told Aviation Week that this was not the company's intent, and that at before the initial 30% ownership should be divided up in a balanced way among the communications manufacturers as well as the aerospace carrier. Lockheed, whose own proposal to establish an independent joint venture included GE's plan but which voluntarily stepped aside when the aerospace industry expressed a preference for owning the system themselves, told the FCC that "It is not up to the international carrier to show when and how this can be done. However, if they can get in in the immediate future, the other private interests who have indicated a willingness and readiness to do so, the establishment of a satellite system should be given the opportunity to do so."

Aerospace Firm Handcuffed

Lockheed expressed concern that aerospace companies with competence in the satellite field be handicapped in bidding for system research, development and hardware procurement unless adequate safeguards are provided to restrict ownership as admitted to system ownership. Lockheed points out that three of the aerospace carriers at that point—companies—AT&T, International Telephone & Telegraph Co. and Radio Corp. of America—have large research and development laboratories and manufacturing facilities.

"If the international carriers through their related business companies, conduct all of the research and development prior to the final organization of the joint venture, the other companies such research and development in the past venture, all activities would be effectively excluded from the 30% plan," Lockheed said.

Lockheed pointed out the need would be that the carrier's control over design and engineering specifications would "disregard any practical effects in building other business manufacturers for the ultimate equipment."

It suggested that communications manufacturers may not be allowed to participate through ownership. Lockheed said that FCC require the common carrier to first open the research and development phase to competitive bidding.

"It is important, Lockheed said, if the U. S. is to be first with a satellite communications system. The company said it would be interested in this system and would like to see "if any communications post rather model space"

British Designing STOL Freighters

London—Free British aircraft, one of U.S. derivatives, are under design for a British Air Force requirement to conduct replace the Blackburn Buccaneer tactical transport, with emphasis on VFR capabilities.

British Aircraft Corp. is working on two aircraft to fit the requirement, which broadly specifies a turboprop-driven, four-engine STOL capable of payloads in excess of 50,000 lb. at gross weights of about 110,000 lb. The plane also would have excellent on-land landing.

One of the British Aircraft Corp. designs, the BAC 212, is on the basis of British Aerospace. This airplane would be powered by four British Rolls-Royce RB 513 turbo engines now used by the British F-107 close-support fighter. The other is the BAC 212B turboprop-driven version of the Lockheed C-119 where, for the power requirement, would be powered by four Rolls-Royce RB 513 engines. The Lockheed BAC 212B has been demonstrated to the RAF. Downward trend of an agreement between Lockheed and British Aircraft Corp. The typical reason of the BAC 212 would be manufactured by the British Air Force under license of selected by the RAF for the STOL transport requirement.

At Avondale, Washington, is centered on the AV 500 transport, an enlarged version of the AV 450 Agony, which would use four RB 513s as the power plants. A follow-on version, giving less immediate emphasis, would use a combination of RB 513s with light-weight lift engines, possibly Rolls-Royce RB 108s, on outboard nacelles. A design involving one of a cluster of RB 108s in combination with five engines in a cluster of nacelles in the VFR, purpose (AV May, 11 p. 277) has been dropped.

Short Boeing & Lockheed B-107, but proposed a boundary layer tested version of its B-107 freighter was under construction for RAF. B-107 would come from its RB 107 but to be replaced by a B-107 on the open market.

Although the RAF has used its dual requirement for the B-107 replacement, the British Government has not yet made any final decision. All design was made by an company design.

the expense of those who have participated in the unique satellite system of the Defense Department over the past 5 years and attempt at this late date to submit to the government knowledge and experience in this highly specialized field. (Then the approach comes in being.)

There is a definite void reference to AT&T which is attempting to design the experimental communication satellite largely with its own Bell Telephone Laboratories staff. The company has been reluctant to hire new staff elements, preferring to do the overall business management itself.

In recent weeks, however, AT&T engineers have visited a number of aerospace companies to discuss the possibility of giving them study development contracts for work on small subsystems.

During one such visit, the host company asked the AT&T representative about the prospects of future participation by the subcontractor in the event of a subsequent study for AT&T. The reply was that Western Electric is preparing to produce satellites and that production probably would take place here. American Westcoast told The aerospace company was told that AT&T would insist on a majority right to any patents arising out of the aerospace company's study.

Another contract which causes speculation in the aerospace industry involves the Nike Zeus anti-ICBM missile for which AT&T's Western Electric is prime contractor. Lear, Inc., developed the five stabilized platforms used in the Zeus missile and built a new factory at Great Rapids to produce the platforms. Recently, it has been learned that Western Electric will establish itself as a second source in production of the platforms and that the general limited production will be divided between Lear and Western Electric.

An AT&T spokesman told Aviation Week the company expects that "most of our manufacturing will manufacture a substantial portion of the satellite system" which the company has proposed. He does not think Western Electric is establishing a group to produce satellites, or that it has plans to do so.

Commenting on Lockheed's latest news, AT&T told the FCC that the safeguards proposed by the commission in its First Report are adequate to assure equitable competition. "If Lockheed's position is that despite the requirements in Paragraph 9 (First Report), there who obtain and design the system will obtain a competitive advantage, then it follows that Lockheed's request to participate in such planning is for the purpose of obtaining a competitive advantage for Lockheed," AT&T says.

AT&T warns that "there is a pro-

hibit limit to the number of people who can participate in the planning and design of the satellite system. If all the contractors who have sold aerospace goods and services to various government projects were to participate in the discussions between centers, each would be promoting use of equipment designed by it, and decisions would be irreversibly delayed."

"If, as we believe, Paragraph 9 is adequate to protect the interests of

Defense Hires Experts to End Non-Competitive Buying of Spares

Washington—Defense Department is hiring a group of 15 to 25 purchasing experts to eliminate unnecessary duplication, non-competitive procurement of aeronautical spare parts requirements.

Thomas D. Morris, assistant secretary of defense for installation and logistics, reported this to the House Armed Services Subcommittee Subcommittee last week in replying to a spot-check inquiry by General Accounting Office which reported that 1,778 different aeronautical spare parts purchased from nine sources is a total of over \$100 million could have been bought competitively for "upward of \$30 million" less.

Initial studies indicate that 25% to 35% of the \$2.2 billion aeronautical requirements for aeronautical spare parts can be competitively procured, Morris reported to the subcommittee, headed by Rep. Edward Hebert (D-La.). The word will be approximately double the present level.

"If we can succeed in achieving this goal, we will replace savings of tens of millions of dollars," Morris observed.

He also emphasized to the subcommittee the complexity of the undertaking. Defense has 804,000 aeronautical parts in its supply system and each year purchases about 364,000 replacement.

"We have an off-the-shelf mass of a type commercially produced and consumed," he said. "Most have been typically engineered and dropped to meet the existing requirements of military weapons systems. Just to maintain and manage this vast array of special items, our maintenance has a farmed-out at over 15 million drawings and each year new items or modification of old items bring another 4.5 million drawings and specifications into our files. This alone results in one of the largest paperwork management jobs in all of government."

Admitting "very frankly" that until now Defense's files of drawings and specifications have not been brought fully under control," Morris reported

the aerospace and hardware industries, their participation in the system planning and design by one or a few large companies or by all who are interested is unnecessary. The aerospace industry will, of course, be called upon to make important contributions to the success and efficiency of the satellite system. [Here] knowledge and experience will be essential to establish a non-competitive system using satellites." AT&T said.

That a new review is being conducted under which suppliers of drawings and specifications—the key to competitive procurement—will bring manufacturing and field test results on 38M costs. "Once achieved, one file clerk can maintain a file of 250,000 of these files, card, up-to-date at all times and ready for any reference within minutes," he commented. "High-speed processing machines have been revealed which will make a duplicate copy from this master cost about 25¢ apiece."

Morris defended "open contract" procurement of aeronautical spares—the system now widely used under which orders are placed annually for an indefinite period with the price later negotiated—in a limited area because it requires "about one-third of the effort."

He reported to the subcommittee, however, that a new procurement regulation will shortly be issued under which every item considered must be individually evaluated to determine whether it can be bought competitively. This regulation will require that a justification be established in any case where the order is placed under an open contract with a single source. Appropriate reviews of these will be required at a higher level.

"In other words, we will not allow the open contract to be used as a blanket authorization established merely in advance of individual procurements, but rather will authorize its use only in an advance agreement with suppliers which establishes contract terms, its items which are individually found eligible for procurement from that supplier."

Morris stated that he is "not satisfied" that an "adequate job" of pricing is being done on aeronautical spares which must necessarily be purchased from a single source in some instances, he said. Defense will purchase direct from subcontractors although there is a warning "extremely strong" not to purchase through a prime contractor if the prime performer exercises functions of design and quality control.

RESCUE

The Kaman HUSKIE was designed to be a rugged, reliable rescue helicopter. It was bred for the bushlands. The number, nature and difficulty of the rescues it has completed since entering operational service prove it was bred right. Rescues involving Kaman helicopters which hit the headlines recently follow below, with on the spot photos to the right.

A. LARSON AVE, WASH.—A Huskie hovering over the burning wreckage of a B-52D used its rotor downwash to keep flames away from the bomber's 120,000 pound fuel load until 40 crewmen had been safely evacuated. (Dit Peters Photo)

B. CAPE KATTEWA, VA.—When the below Pine Ridge broke up off shore, a Kaman HUSKIE operating from the Valley Forge rescued 90 crew members and delivered them safely to its carrier base. (U.S. Coast Guard Photo)

C. RANDOLPH AFB, TEXAS—USAF H-43 on standby alert reached the crash site of a KC-97 tanker and worked with its lighting crew to prevent flames from spreading to 4,000 gals. of spilled fuel, saving the aircraft. (San Antonio Field Photo)

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.



In national defense KAMAN is a part of the rescue plan.

This demonstration photo shows a rescue at PLATTESBURG, N.Y., when one of the crewmen who built out of a crippled H-33 was injured when hovering in an unstable area of 100 ft. above the ground. The crew of a Huskie used its life by hovering over the spot and lowering a hoist to give first aid and return as the hoist reached the scene.

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NASA Attempts to Sell Program As Broader Than Lunar Goals

Washington—National Aeronautics and Space Administration officials are unusual about the public image of NASA's multi-billion dollar space program and are trying to reduce it as much broader than its effort to reach the moon.

High L. Dryden, NASA deputy administrator, told Aviation Week that "we're obviously getting in trouble with the public" because of the focus on landing on the moon rather than on the accompanying scientific and technological return of the space effort.

He said several NASA officials have been increasingly concerned with the public image and have decided the best way to combat it is to emphasize that getting to the moon is just one goal, not the overall objective of the program. Dr. Dryden said he hopes to be able to portray the moon shot as a research program, similar to the one surrounding the X-15 supersonic airplane where speed advances are secondary to the flight knowledge gained.

NASA Administrator James H. Webb said he would not go as far as to say the agency was "in trouble with the public" but said "we run the risk of losing the phase of getting a moon on the moon aspect the program when the 18 re programs in a (disputed) exploration of space and applying the knowledge gained." He said the agency is trying "to find all possible ways to make this very clear to the public." Webb cited speeches and articles in part of his own effort toward this end, adding that he intends to continue them. He said he has accepted a number of speaking engagements from groups outside Washington.

This broadening effort is being pushed by unusual means of Congress, as was evident last week in the Space Appropriations Committee's Independent Office Subcommittee hearing on the NASA budget.

William G. Magnuson (D-Wash.) told Dr. Dryden that "there has got to be a lot of secondary work in regard to the proposal" so that the people will understand what we are trying to do. The space program has political implications. As it stands now, it looks as if we're just taking a jump at the moon. We're going to have to point out all aspects of that program."

Sen. Gordon Allott (R-Cala.) expressed similar concerns and said he had not been able to convince himself completely that the moon shot is worth the estimated \$10 billion cost. He cited some of the costs along the time line.

"Right now, it seems satellites in

space have more value to defense and the country generally than landing a man on the moon." Sen. Allott asked Dr. Dryden during the hearing, "let such an NASA budget? Dr. Dryden replied that developing advanced satellites is one of the steps in getting to the moon and represents the type of technology developments which will come from the effort.

He added that standing for the moon rather than being in and out of the moon in "getting of a goal which requires use to develop your legs in science and technology."

Sen. Magnuson said the science satellite probably will report the space program's fall to the fall committee next week.

Navy Chooses Bendix For Typhon Program

Washington—Navy selected the Bendix Corp. last week as prime contractor to develop the long-range Typhon sea force radar planned for fleet use. The Typhon system also will include a radarscope range finder. A new type radarscope probe radar for the system is to permit 10 simultaneous targets at 10 miles and provides 15 different radar modes installed in a variety of ships.

The long-range radarscope will have a capability of firing to a 126,000 ft altitude and a range of 200 mi. A high power radar in the middle will enable it to detect or "burn through" heavy countermeasures being in a jamming. It is expected to enter that service in 1966.

Performance drops back on the radar has been done by the Applied Physics Laboratory of the Johns Hopkins University, which will have total direction of its development. McDonnell Aircraft Corp. will build the radarscope.

Soviets, British Fail To Track Venus Probe

Repeated attempts by Soviet and British spacecraft to establish radio contact with the Soviet Venera Venus probe at the Jodrell Bank tracking facility have failed. The probe was launched Feb. 12, and communications were lost Feb. 27.

Soviet Prof. Alex. Moisevich and Dr. Iosif Kozlov, vice at Jodrell Bank, Jan. 9-16, to meet on the tracking USSR, said the probe passed within 62,520 mi of Venus May 19-20.

News Digest

Vice Adm. George W. Anderson was named as chief of naval operations with immediate rank, but will be replaced by Adm. Arthur A. Burke who is to retire Aug. 1. Adm. Anderson, 54, currently is commander of the U.S. Sixth Fleet and of Naval Air Station and Support Force, South Korea.

General Dynamics Corp. is meeting as headquarters division. Contracted out a meeting of the General 386 and 1968 fiscal year budget was decided by directors last week in a major session for passing the dividend, set from 50 cents to 25 cents quarterly last year.

House-passed President Kennedy's plan to alter the Civil Aeronautics Board last week, and unless the Senate objects the plan goes into effect July 1. Contrary to the plan, however, the chairman to displace Bessie Coleman to a Board director, CAB member, leaving chairman or Board employee.

Federal Aviation Agency plans to discuss the first draft of a regulation governing certification requirements for turbine-powered helicopters with its recently formed Helicopter Air Carrier Advisory Group on July 6. A preliminary meeting between the advisory group and FAA Bureau of Flight Standards officials was held last week.

Air Force has authorized control of the design of automatic data processing systems under the Air Force Computer's Office. Col. George H. Kruger, named Assistant for Data Automation, will define objectives and policy for developing business data systems and command and control systems within the Air Force.

Air Force estimates at least a million environmental particles were trapped in its December 15 payload in a light early this month (AW June 12, p. 38). Concentration of particles is 100 times earlier criteria.

Air Force Systems Command has officially adopted Navy's terminology of VLSR (Program Evaluation Review Technique) and abandoned its own name of PEP, in part of an effort to achieve intensive standardization in terminology and techniques.

Dupont Air Lines has ordered a sixth Douglas DC-3 a turboprop-powered version, for March 1962 delivery. The carrier last year DC-3s which the firm is a second-hand trading company in Tulsa, Okla. The new line, for DC-3s will exceed 50 in other marketing space.

Halaby Urges Congress to Support Supersonic Transport Program

Washington—Federal Aviation Administrator Nighthall E. Halaby urged Congress last week to support development of a supersonic transport to the U.S. seventh industry can capture a larger share of the world market.

He said the supersonic transport is "the next major aviation and powerplant combination, is about a \$1 billion market and therefore a great prize. We have to have a partnership between the government and the industry to get this thing built at any time, much less sooner than the Russians."

The FAA administrator cited figures showing the decreasing percentage of the world airplane market going to U.S. manufacturers. He said the government has an obligation to do what it can to help the industry, and called FAA's request for \$17 million to start a supersonic transport design study a vital "minimum step" toward this end.

Halaby told the Senate Appropriations Sub-Committee of the Senate Committee on the Judiciary that the feasibility study is a matter of equity when compared with the work of the civil program. "Now if this nation waited to waiting to go to the moon waited to go to New Delhi as a commercial enterprise, we would have had a national project,"

supplied a lot sooner than 1970-77, when a commercial profitable airplane could be developed. But it is not," Halaby said, "as I understand it, not national policy as done to go to Mach 3, to Paris or New Delhi to come in as it is to the moon."

The airline industry wants FAA to conduct the study, Halaby said, "so though there is no consensus in their [airline] demand for a commercial supersonic transport due to the high debt load and their low profit margin," he told the subcommittee, "they are a recognition by the airline providers, conservative as they are, that it is a trend that we are going to develop it in a commercial as distinguished from a military context to develop it commercially and capture the civil, and particularly," Halaby said, "North American Airlines interests. It would cost \$500 million to develop a supersonic transport. The transport ultimately would sell for \$15 million to \$16 million and should have a range up to 1780 miles an hour."

Commenting on the possibility of modifying the North American B70 eventually as a transport, Halaby said that it will be too costly and too late to develop. He said he is not in a position to comment on it.

The FAA is requesting \$12 million for fiscal 1982 for the supersonic transport feasibility study and plans to spend an additional \$37 million the following year. The House has passed a bill to appropriate only \$15 million for the study. At fiscal 1982, also, the House Appropriations Committee in its report recommending that amount said FAA should not spend over \$20 million for the first two years of the study. Halaby told the Senate subcommittee the agency would either not conduct the study, at all, or try to conduct it within this \$12 million limit.

Halaby said the Senate subcommittee would not object to a study made by the House in the FAA budget, including \$15 million for a wind tunnel to determine how best to fight supersonic flow. The House Appropriations Committee is drawing the tunnel request, and FAA should match government and industry should in government. But Halaby said this would be more expensive than building a new one now, since there are several existing wind tunnel facilities in the United States. The FAA hopes to build the tunnel at its Atlantic City facility.

Halaby considered there is duplication between civilian and military agencies and other agencies and is the gathering of weather information. But a study on integrating military and civilian air vehicles is just about completed.

Supreme Court Denies Retiring Age Review

Washington—Mandamus, a request for review of a decision by the U.S. Supreme Court last week when it refused to review a lower court decision supporting the controversial Federal Aviation Act.

Denial of the petition for review, filed by the Air Line Pilots Assn., removed the last legal threat to the regulation, which has been in effect since March, 1969.

FAA Administrator Nighthall E. Halaby, who earlier indicated that he might review the regulation, announced last week he is letting it stand.

Halaby, advised ALPA President Clarence N. Smith that after a careful study of all facts and after talks at a recent meeting of the International Civil Aviation Organization, he considers the regulation a "fair and reasonable" answer to the question of retirement age. During the ICAO discussion, he said, most countries supported a retirement age of less than 60. Promising to offer help in phase-inning at this age, Halaby also told ALPA to seek "fair and equitable treatment" from the industry.

CAB Sets Rate Floors for MATS Lift

Washington—Civil Aeronautics Board, Frank, among its authority as a new rate, has established rate floors for airlines seeking Lower and Quick-Turnaround services under MATS.

Exercising its power to set on or exempt applications, the Board ruled last week that the rate floors MATS be at U.S. carriers were "concomitantly low and inadequate to cover operating costs and provide a reasonable opportunity to earn a fair profit."

AARINC, Shide, Reddy, World Alaska and Capital as the Lower and Quick-Turnaround carriers affected by the Board's action. In some cases, the rates filed on the last compliance for fiscal 1962 carriers (AW June 12, p. 17) were 20% lower than the appropriate CAB minimum.

For more than a year the Board has applied maximum rates to certain air BP contracts entered by MATS. By applying Part 244 of its maximum regulations, under which blanket exemptions have been granted to domestic construction CAB served, rather than it would broaden the scope of the control, despite Defense Department objections.

Commenting on the Board's new power during hearings on MATS last week, the House Transportation Subcommittee indicated it will not pass judgment on the domestic maximum until they have been in effect for some time. But Chairman Cliff Hoffeld (D-Calif.) said the question of whether CAB is setting maximums on "intrastate" on MATS activity.

Herbert Reback, subcommittee staff administrator, also told Aviation Week.

Continental Buys 720RBs

Washington—Continental Airlines will purchase a fleet of four Boeing 720B transport powered by Pratt & Whitney JT9D-1 turbofans engines at a total cost of \$27.5 million. Delivery is scheduled for next spring.

The replacement program is being financed through a loan of \$20.5 million of which \$17.5 million has been placed by Leasco. Boeing has built and long-term maintenance. Boeing will be assigned for the 720B fleet from other sources including internal cash generation.

These expenditures will participate in the first Airline Life Insurance Co. Co. National Term Life Insurance Co., New England Life Insurance Co., Paul Fidelity, Connecticut General Life Insurance Co., American Life Insurance Co., Infancia Standard Life Insurance Co. and 19 funds headed by Chase Manhattan.

that the congressmen are interested in the respect the newly announced rates would have on the "upgrading and modernization" of the Civil Air Transport Service.

Following before the subcommittee, Joseph S. Hoot, assistant secretary of the Air Force material, said that "the objectives of our program cannot be achieved if certain quick-turnaround rates which could result in increased production and loss of capability." He acknowledged that some of the current bidding for domestic contracts had quoted very low rates and expressed concern over the quality of their current production and repair.

At a public hearing, Air Force "acquainted the chairman of CAB to review these rates to determine whether they are fair and reasonable, and to possible legislative action in the event the quoted rates were not satisfactory."

Despite Air Force concerns with the low bids, at least one carrier, World Airways, apparently was loath to accept a continuing rate controls. World Airways, which is a member of MATS, petitioned CAB for an exemption and "other relief." World stated:

"On June 2, World was notified by MATS that it could be awarded item 1 of one of three Lower contract rates bid for at a rate of \$1,160 per month (Douglas DC-6A) rate, which rate was \$1.8 cents per mile; then the rate which had been bid by World. World was given an opportunity, which was not provided in July 1962, to make the rate offered a below the direct operating cost of World. On the contrary, World was told that it must either accept or reject the rate of \$1,160 per month to be entered on the contract, or the carrier believed to be excluded."

The rate floor set by CAB will take effect July 1 and has for 90 days while the Board considers a full-scale study on future rate maximums. It is applied after Oct. 1. Temporary maximums by CAB are \$1.95 per month mile for Douglas DC-4s, in Quick-Turnaround operations and \$1.45 per month mile for Douglas C-46s and DC-6Bs, respectively, on Long-Haul operations.

MATS told Aviation Week that at least three possible sources of airline new have associated late last week in the wake of CAB's study that Lower and Quick-Turnaround carriers had filed an economic bid. Specifically, MATS was negotiating whether or not to:

- Reduce the rate floor to match its contract terms bringing the weekly up to CAB's rate floor without increasing its cost in the process; or
- Increase the daily rate floor at each disputed award to conform with the new CAB maximum.

• Reduce the contract awards made and make new bids from the industry.

Because maximum rates are scheduled to begin service July 1, the Defense Department is expected to do what it can to make a second, under-the-table bidding contract and the congressional compromise that might result. For this reason, the reporting of the awards and the distribution of a second report for proposals is considered unlikely.

Basnigh Will Head FAA Southern Region

Washington—Federal Aviation Agency's new regional organization centered in Atlanta, Ga., will be headed by Arvin Basnigh, appointed assistant administrator for Southern Region by Administrator Nighthall E. Halaby.

Formerly deputy assistant administrator for management services, Basnigh will take charge of all agency field programs in the new Southern Region, which encompasses Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, Mississippi, the Carolinas, Puerto Rico, the Virgin Islands and Guam.

Scheduled to begin operations Jan. 1, the Southern Region was split off from FAA's Region III, which now covers only Arkansas, Louisiana, Oklahoma, Texas and New Mexico. When it is fully staffed in July 1962, the new region will consist of about 400 people.

Paul H. Bottum, now chief of the air traffic management division at Region III, will serve under Basnigh as deputy assistant administrator.

In addition to his assignment as organization, Halaby has named Region I's Eastern Region with headquarters in New York City, Region II the Southern Region with headquarters in Atlanta, Region III the Central Region with headquarters in Kansas City, Mo., and Region IV the Western Region with headquarters in Los Angeles. Alaska and Hawaii comprise the ninth and seventh FAA regions.

Pan Am Files SAS Charge

Pan American has filed Civil Aeronautics Board to take action against Swissair's Airline Swissair, including possible withdrawal of the right of Swissair to fly to New York City. Swissair was denied to serve the U.S. through the SAS. Swissair's arrangement, set in 1958, was terminated in 1961 (AW June 29, p. 10). Pan Am charges Swissair with offering service "in violation" of basic route demands and violating its license as carrier permit and bilateral.

Supersonic Transport Design Guides

By Walsh, Tex.—Basic research parameters for a supersonic transport will be studied by the National Aeronautics and Space Administration and the Federal Aviation Agency by the end of 1962.

Research and development program currently under way by these agencies are geared to "writing the book" for the producers of manufacturers and airlines is the next 12 to 15 months, high-level NASA and FAA officials indicated here last week at a supersonic transport symposium. The symposium was sponsored by the Institute of Navigation in conjunction with the U.S. Air Force.

The aircraft industries, airlines and government agencies are now discussing a program leading to a fully transcontinental supersonic transport that would be suitable in the 1970 time period. The NASA and FAA officials indicated that they are studying the following:

- Although it is too early to be definitive about the performance of the model airplane, they will be undertaken, government financial assistance to industry will fund development programs as design with ultimate performance in the Mach 3 regime.
- Successful replacement of the supersonic transport will require development of a special fuel system and engine design to suit the performance variations that their new airplanes will impose on demands and environmental or temperature.

Indications are, that the economic and operational issues the initial airplanes will have performance that of Mach 3, but it appeared clear that government agencies involved in the program would be very of supporting any program for a supersonic airplane that can fly faster than the speed of sound. The Institute of Navigation is studying the feasibility of a Mach 3.5 supersonic speed modification. With the present state of the technology, the Institute that materials availability, for example, would be affected on the basis of their capability of withstanding high temperatures and loads imposed by this performance and would not let the light off.



BAITMENT AIRPORT (right, center) provides San Francisco & Oakland Helicopter Airline with landing area within distance of city's financial district. One of the carrier's two Sikorsky S-62 helicopters is making approach over the Ferry Building. The heliport was originally part of a parking lot. Ticket office and waiting room are in the Ferry Building.

S-62 Service Is Begun in San Francisco

San Francisco & Oakland Helicopter Airline, currently negotiating Sikorsky S-62s between four heliports in the San Francisco Bay area, is averaging 50-60 passengers per day, and hopes to double this figure within 90 days.

The average load has increased from 40 per day when the airline began service June 1. Approximately 1,500 passengers per day, or slightly more than 91,000 per week, are needed for the line to break even financially, according to M. P. Bagan, president of the line.

Both of these projections are being carried from downtown Oakland to San Francisco International Airport. The present Oakland International Airport will not accommodate jet liners.

The line desired scheduled flight frequencies twice weekly after beginning operations and now has approximately 65 point-to-point flights per day between 6:30 a.m. and 10:30 p.m. including San Francisco and Oakland airports and downtown heliports in both cities.

Currently operating as an air taxi service under a Market exemption granted by the Civil Aeronautics Board, the non-subsidized airline plans eventually to request service within a 100-mile radius (AW June 18, p. 43).

Negotiations now are under way with the city of Berkeley for construction of a downtown heliport there and the air line hopes to begin service within 30 days.

Other cities which may receive

heliporter service are Sacramento, San Jose and Palo Alto.

The line operates two 100-passenger Sikorsky S-62s and has an option on a third. If traffic volume permits, a 28-passenger Sikorsky S-61L may be added.



MAINTENANCE WORK on San Francisco & Oakland Helicopter Airline is performed in hangar of Pan American World Airways hangar at San Francisco International Airport. Ground offices of the line also are in the building. Pan Am Douglas DC-8 is in front.

Rogers, says firms are comparable to airlines but face it on the spot. The line from downtown Oakland to downtown San Francisco and from downtown San Francisco to San Francisco International Airport is \$6.30 one way. The line from downtown Oakland to San Francisco International is \$7.50.

The line runs 9,000 sq ft of hangar space from Pan American World Airways, Inc., at San Francisco International. It provides office, storage and maintenance use. It shares ticket and waiting room facilities of the field with United Air Lines, but has separate facilities at Oakland International. The line has multiple seating and baggage compartments with major carriers.

The line states to be the first to operate an all-helicopter fleet. Approximately 99% of the flights are over water.

Bagan, president of the line, formerly

was a trial attorney for the Civil Aeronautics Board Bureau of Air Operations, vice president of Los Angeles Airways and director of research for Coastal Airlines. Other officers include John J. Cunningham, vice president assistant to the president; Bruce P. DeLia, vice president operations; Charles M. Schmitt, director of maintenance; and Roger E. Hill, director of traffic and sales. In addition to the five-man management team, the airline employs a staff of 70.

The downtown San Francisco heliport is located on the waterfront at the foot of Market St., adjacent to the Ferry Building & A temporary heliport at downtown Oakland, alongside the Oakland Auditorium, currently, is served by the line. Later, service will be moved to a heliport atop a seven-level parking garage which is planned to be constructed soon.

British Independents Score BOAC, BEA on Foreign Pool Agreements

By Herbert J. Coleman

London—Pooling agreements made with foreign carriers once defunctified by British European Airways and British Overseas Airways Corp. against at odds by independent airlines at the Air Transport Licensing Board against licensing as a complex set of United Kingdom-European issues.

The Board has allocated about six weeks to line agreements on 72 routes, many of which have been the province of British European Airways until Parliament amended the Air Transport Licensing Act to allow independent to participate (AW May 22, p. 34).

The largest independent, British United Airways, seeks operating rights on 23 routes. Coastal Eagle on 15, Overseas Airways on 18, Transair on Silver City and Starline three each and First Atlantic Three Services two.

Initially, BEA is seeking four new routes: London-Cairo, London-Madrid, London-Mexico and London-Lagos. Modern because of the mass of routes—15 objection are entered, making nearly 400 total objections, some opposition also act in opposition to each other—the board is leaving the replies, as alphabetical order.

Independent strategy appears to center on attacking BEA and British Overseas Airways Corp. pool agreements as contrary to monopoly. BOAC's deal with Montreal, Canada, Air Lines, a 30-80 sharing in traffic, was first disclosed in late detail of the North Atlantic route between (AW May 28, p. 35).

Capgem of BEA pool agreements have been filed with the board but have been treated as confidential documents and are not open to any detail during the public hearings.

Independent airlines attacks took form when Gerald Gardner, counsel for British United Airways, moves around railway B. Malabar, BEA chief executive, on the intercontinental aircraft's relationship with Air France on the London-Paris high-density air traffic route.

Malabar, asked by Gardner "if the line was not a failure, it is a complete monopoly" implied in the alternative line line amended has an asset to point out that no Fifth Freedom carriers also BEA's route "that they do not carry a large proportion of the traffic."

In Malabar's view, the London-Paris pool allowed the two national flag carriers to hold the line on lines as what he called a "short, expensive route, and not to benefit the public by service and equipment. Said Malabar, "no one has suffered through the pool agreement."

Gardner asked how many passengers are limited only by BEA and Air France, and local factors often not seen 50%, but Malabar said there could be as low as keeping such a record. He said BEA policy is to provide extra flights where traffic warrants and noted that the 25% extra flights are only during the peak months of July, August and September.

In an apparent contradiction, Malabar told Gardner, as to the entries on fees, that BEA policy would be to

continue to drive for lower fares, primarily as introduction of night services and more tourist-investigation airplanes.

But he admitted that BEA "plans to go ahead" with International Air Transport Association member airlines who are seeking a 5% across-the-board fare hike in the winter months. He said BEA would support this as one of many costs now paying off services.

In citing BEA's general position on rate application, Henry E. Mink, corporation secretary, reflected BOAC's position that allowing the independents parallel services will cut into BEA's point market over a long period of time. He said the board is referred to BEA's order for British aircraft amounting to about \$746 million and stressed that "high inflation is a necessary" if BEA is to operate this fleet profitably.

On the other hand, British United points out that it has ordered four Valiant VC-10 long-range jets and 38 BAC 111 medium-range jets at a total cost of about \$50 million and Coastal Eagle has ordered two Boeing 707-420s. These costs applied for by BEA are, Mink emphasized, "not designed to take traffic away from another British operator licensed for the same routes." Applications by the independents, he said, are not open to any detail where others have shown "where BEA's applications result from long-passed development programs."

The British flag now uses 35 cities, 24 in Britain and 11 in Europe and the Middle East. Malabar noted that despite present competition on the routes, BEA still carries 75% of all air traffic in Europe this year. Another factor, he continued, is that BEA has written off its fleet and has had a turnover of more than \$10 million.

In stating British United's case, Gardner objected to pooling agreements being filed as evidence for board eyes only, contending it is a well-recognized principle of English law that a board of the kind, covering quasijudicial functions is not entitled to receive evidence from one party without allowing it to the other party.

BEA, he said, offered a preliminary draft copy of a proposed pooling agreement but not a copy of an actual working agreement. The state airline's position has been that developing pool details would require future negotiations with foreign carriers.

British United claimed, as support of its applications, that today's air providers is paying too much for its traffic and that a large, standard pool is available. Gardner implied that BEA's low fares in North Atlantic travel followed low reductions, but pointed out that there have been no reduced fares in Europe since board rules were introduced in 1975.

News of Local Service Airlines

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Texas tells business and government leaders about the vital contribution of local airlines to American business activity through regular ads like this in *Business Week*.

This new campaign reports on ways to use local carriers to increase sales, reduce costs, solve problems, give promotions, or relax.

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Omaha
Pacific
Piedmont
Renaissance
Southern
Texas Texas
West Coast
Wey Alaska

Ready to take to the sky . . . on P-22. Refueling car by — Northern Consolidated Airlines prove it. Last November, the line transported 43 live reindeer on the first lap of their journey from Nainok Island, Alaska, to Los Angeles. Some of Santa's helpers seemed a bit startled by this new experience, but all arrived live and kicking.

"This goes to prove that local carriers can transport almost anything—safely and quickly. In the words of a local carrier sales representative, "If it's transportable, we'll find a way to take it."

Foreign tourists may favor smaller U.S. communities. Backed by vigorous promotion by the Federal Government and growing prosperity abroad, foreign tourism to the U.S. could be as much as quadruple in the next decade.

Smaller communities offer many unique attractions to the foreign visitor — local color, historical points of interest, plus generally lower prices for accommodations. Judicious planning, in conjunction with local airline service, could enable these communities to capture a big share of the foreign tourist trade.

For example, a vacation trip for the foreign visitor might include historical homes, cities, and battlefields of the Middle Atlantic states — accessible through **Piedmont Airlines**. For a glimpse of America at its fairest, best, he might visit such places as Las Vegas, Reno and Palm Springs on all-jet **Bonanza Airlines** flights.

Many local service airlines already offer "package" vacation tours to points of interest in their territories.

Boeing operation rebuilds economy of 19th Illinois cities. When civil leaders of Moline-Harris, Illinois, launched an all-out campaign back in 1943 to attract new industry, they gave air transportation top priority. A new multi-million dollar airport made the area readily accessible via **Omak Airlines**.

Since then, no less than 80 new industries have moved into the area. Nearly 5,000 new jobs have been created. Air service has made an important contribution to this spectacular growth and has more than kept pace with the area's booming economy. Every month, **Omak** flies an average of 600 passengers and 20,000 pounds of cargo in and out of Moline-Harris.

Commuter-type, no-connection service speeds businessmen in a hurry. Fast, frequent, commuter-type flights offered by many local carriers are made-to-order for businessmen who want to get around. Because of these flights, it is now possible to visit as many as four cities—hundreds of miles apart—in a single day.

Allagany Airlines offers an exceptionally convenient commuter service. Room-cabin and baggage check-in are unnecessary between such key cities as Pittsburgh, Philadelphia, Providence and Boston. Even ticketing is done in flight. Best of all, fare discounts average 35%.

Frontier Airlines schedules twice-daily commuter-type flights to most major cities in the Denver area. And **North Central Airlines** flights connect Chicago many times daily with such cities as Milwaukee, Detroit, Deloit and Minneapolis.

U.S. Delays Italy's Los Angeles Entry

By Gloria Gertman

New York—United States is delaying Italy's authority to serve Los Angeles as an attempt to force the Italian to support the U.S. interpretation of what constitutes Fifth Freedom traffic.

This interpretation is a critical issue in the current hot Italian battle (AW June 19, p. 38), and Italy appears to be in the hot of fire from both U.S. and European sides.

Under a U.S.-Italian agreement of last summer which gave Los Angeles and Chicago rights to Italy, American Wings has learned, both countries agreed to provide traffic statistics including primary and secondary Fifth Freedom figures as defined by the United States. The amount of reports provided under these provisions is at the core of the dispute between the U.S. and several European countries.

The Italians have provided the required statistics. But the U.S. now further argues the Italians is still not fully satisfied that such information is called for under the original Rome-Paris agreement of 1945. In other words, the U.S. wants the Italian to go in accord with a bilateral interpretation that other European countries are following.

The Italians feel this would put them squarely in the middle of the bilateral battle. Other countries usually let the Scandinavians, rather than the U.S., make the decision on what is called for under the agreement to increase Fifth Freedom traffic and what the U.S. calls "Sixth Freedom" traffic—traffic going beyond the second country under a bilateral agreement.

The U.S., according to the Italian view, seeks to use Italy as a wedge

against other countries in the dispute. It is that concerned about its relations and agreements with the other countries.

The U.S. State Department has no comment at this time on the Italian view.

The new Italy-U.S. agreement was supposed to have been followed up last December by an exchange of explanatory notes calling the issue forth. But while the U.S. rejected approval of Chicago, no further word developed on Los Angeles. Italy was to have been able to serve a Los Angeles-Moscow Rome route net later than May 15 or earlier if certain U.S.-Canada negotiations were completed.

According to Atlanta, it was such an attempt to start Los Angeles service on schedule and had made preliminary arrangements at the West Coast city in preparation for the service.

But when a U.S. team came announced to Rome last year to work out the technical details of the exchange of figures, it developed that the U.S. rejected the interpretation to be continued also. And there the matter stalled. Italy has since provided the statistics but not the confirmation of interpretation and no further for Los Angeles has been forthcoming.

Meanwhile Italia has not altered serving Chicago, maintaining that such service is not hampered at this time.

The needed agreement of last summer calls for exchange of statistics covering origin and destination traffic carried in and out of each country. Each country will report traffic on board its international flight segments between a point in the other country and the nearest port served outside the other country. Origin and destination

information will be broken down between Third and Fourth Freedom traffic on one hand, and Fifth Freedom traffic on the other hand. Fifth Freedom traffic is then split by aircraft type, primary and secondary Fifth Freedom, defined as follows: primary Fifth Freedom is traffic which is Fifth Freedom to the airport of both countries.

Statistics on board also will be exchanged on an origin and destination basis. Another provision is for reporting of volume of passengers and freight traffic carried out but not captured or deposited in Italian territory.

In the Italian view, provision of such statistics is a part of the new agreement and does not imply that the origin and destination should be interpreted as requiring such information. Also the figures would be used to negotiate any future differences regarding capacity in other countries in scheduling to be discussed at that future time, according to the Italian.

Last summer's U.S.-Italy agreement also covered procedures for handling scheduled changes in reports. U.S. law does not require basic flight data to file schedules, whereas Italian regulations do require. Consequently, the U.S. agreed to file such notice of a major schedule or capacity increase. It also follows its official desire. If the changes involved problems from the Italian point of view, an attempt to work out differences would be made during this period. If the attempt failed, Italy could then request a formal consultation under the agreement's terms.



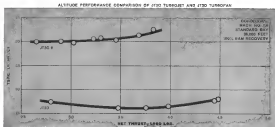
China's CAT Receives First Convair 880-M

First Convair 880-M was recently delivered to Nationalist China's flag carrier, Civil Air Transport, and christened by the airline as the *Manchuria Jet*. Aircraft has 60 passengers in full-cabin section and 54 in the tourist cabin. Powerplants are General Electric CJ 805-16 engines, rated at 11,600 lb. thrust. Fuel capacity of the 880-M is 12,514 gal., 1,790 gal. more than the basic 880. Range is 5,790 mi.

JT3

Compared with the conventional turbojet, the Pratt & Whitney Aircraft JT3D-3 turbofan engine has demonstrated a saving of over 15 per cent specific fuel consumption at comparable cruise thrust. (See chart below.) The effect on operating expense is obvious—less fuel, lower costs. Furthermore, the turbofan's fuel economy is paired with a 22 to 26 per cent lower specific weight than conventional turbojet engines operating today. As a result, the Pratt & Whitney Aircraft JT3D-3 makes possible increased payload, and more than 20 per cent greater range.

PRATT & WHITNEY AIRCRAFT Division of UNITED AIRCRAFT CORPORATION, East Hartford, Connecticut

[illegible][illegible]

and the following companies:
 1981-1982: 1982-1983: 1983-1984: 1984-1985: 1985-1986: 1986-1987: 1987-1988: 1988-1989: 1989-1990: 1990-1991: 1991-1992: 1992-1993: 1993-1994: 1994-1995: 1995-1996: 1996-1997: 1997-1998: 1998-1999: 1999-2000: 2000-2001: 2001-2002: 2002-2003: 2003-2004: 2004-2005: 2005-2006: 2006-2007: 2007-2008: 2008-2009: 2009-2010: 2010-2011: 2011-2012: 2012-2013: 2013-2014: 2014-2015: 2015-2016: 2016-2017: 2017-2018: 2018-2019: 2019-2020: 2020-2021: 2021-2022: 2022-2023: 2023-2024: 2024-2025: 2025-2026: 2026-2027: 2027-2028: 2028-2029: 2029-2030: 2030-2031: 2031-2032: 2032-2033: 2033-2034: 2034-2035: 2035-2036: 2036-2037: 2037-2038: 2038-2039: 2039-2040: 2040-2041: 2041-2042: 2042-2043: 2043-2044: 2044-2045: 2045-2046: 2046-2047: 2047-2048: 2048-2049: 2049-2050: 2050-2051: 2051-2052: 2052-2053: 2053-2054: 2054-2055: 2055-2056: 2056-2057: 2057-2058: 2058-2059: 2059-2060: 2060-2061: 2061-2062: 2062-2063: 2063-2064: 2064-2065: 2065-2066: 2066-2067: 2067-2068: 2068-2069: 2069-2070: 2070-2071: 2071-2072: 2072-2073: 2073-2074: 2074-2075: 2075-2076: 2076-2077: 2077-2078: 2078-2079: 2079-2080: 2080-2081: 2081-2082: 2082-2083: 2083-2084: 2084-2085: 2085-2086: 2086-2087: 2087-2088: 2088-2089: 2089-2090: 2090-2091: 2091-2092: 2092-2093: 2093-2094: 2094-2095: 2095-2096: 2096-2097: 2097-2098: 2098-2099: 2099-2100: 2100-2101: 2101-2102: 2102-2103: 2103-2104: 2104-2105: 2105-2106: 2106-2107: 2107-2108: 2108-2109: 2109-2110: 2110-2111: 2111-2112: 2112-2113: 2113-2114: 2114-2115: 2115-2116: 2116-2117: 2117-2118: 2118-2119: 2119-2120: 2120-2121: 2121-2122: 2122-2123: 2123-2124: 2124-2125: 2125-2126: 2126-2127: 2127-2128: 2128-2129: 2129-2130: 2130-2131: 2131-2132: 2132-2133: 2133-2134: 2134-2135: 2135-2136: 2136-2137: 2137-2138: 2138-2139: 2139-2140: 2140-2141: 2141-2142: 2142-2143: 2143-2144: 2144-2145: 2145-2146: 2146-2147: 2147-2148: 2148-2149: 2149-2150: 2150-2151: 2151-2152: 2152-2153: 2153-2154: 2154-2155: 2155-2156: 2156-2157: 2157-2158: 2158-2159: 2159-2160: 2160-2161: 2161-2162: 2162-2163: 2163-2164: 2164-2165: 2165-2166: 2166-2167: 2167-2168: 2168-2169: 2169-2170: 2170-2171: 2171-2172: 2172-2173: 2173-2174: 2174-2175: 2175-2176: 2176-2177: 2177-2178: 2178-2179: 2179-2180: 2180-2181: 2181-2182: 2182-2183: 2183-2184: 2184-2185: 2185-2186: 2186-2187: 2187-2188: 2188-2189: 2189-2190: 2190-2191: 2191-2192: 2192-2193: 2193-2194: 2194-2195: 2195-2196: 2196-2197: 2197-2198: 2198-2199: 2199-2200: 2200-2201: 2201-2202: 2202-2203: 2203-2204: 2204-2205: 2205-2206: 2206-2207: 2207-2208: 2208-2209: 2209-2210: 2210-2211: 2211-2212: 2212-2213: 2213-2214: 2214-2215: 2215-2216: 2216-2217: 2217-2218: 2218-2219: 2219-2220: 2220-2221: 2221-2222: 2222-2223: 2223-2224: 2224-2225: 2225-2226: 2226-2227: 2227-2228: 2228-2229: 2229-2230: 2230-2231: 2231-2232: 2232-2233: 2233-2234: 2234-2235: 2235-2236: 2236-2237: 2237-2238: 2238-2239: 2239-2240: 2240-2241: 2241-2242: 2242-2243: 2243-2244: 2244-2245: 2245-2246: 2246-2247: 2247-2248: 2248-2249: 2249-2250: 2250-2251: 2251-2252: 2252-2253: 2253-2254: 2254-2255: 2255-2256: 2256-2257: 2257-2258: 2258-2259: 2259-2260: 2260-2261: 2261-2262: 2262-2263: 2263-2264: 2264-2265: 2265-2266: 2266-2267: 2267-2268: 2268-2269: 2269-2270: 2270-2271: 2271-2272: 2272-2273: 2273-2274: 2274-2275: 2275-2276: 2276-2277: 2277-2278: 2278-2279: 2279-2280: 2280-2281: 2281-2282: 2282-2283: 2283-2284: 2284-2285: 2285-2286: 2286-2287: 2287-2288: 2288-2289: 2289-2290: 2290-2291: 2291-2292: 2292-2293: 2293-2294: 2294-2295: 2295-2296: 2296-2297: 2297-2298: 2298-2299: 2299-2300: 2300-2301: 2301-2302: 2302-2303: 2303-2304: 2304-2305: 2305-2306: 2306-2307: 2307-2308: 2308-2309: 2309-2310: 2310-2311: 2311-2312: 2312-2313: 2313-2314: 2314-2315: 2315-2316: 2316-2317: 2317-2318: 2318-2319: 2319-2320: 2320-2321: 2321-2322: 2322-2323: 2323-2324: 2324-2325: 2325-2326: 2326-2327: 2327-2328: 2328-2329: 2329-2330: 2330-2331: 2331-2332: 2332-2333: 2333-2334: 2334-2335: 2335-2336: 2336-2337: 2337-2338: 2338-2339: 2339-2340: 2340-2341: 2341-2342: 2342-2343: 2343-2344: 2344-2345: 2345-2346: 2346-2347: 2347-2348: 2348-2349: 2349-2350: 2350-2351: 2351-2352: 2



THE GRUMMAN GULFSTREAM in a brand new "off-the-shelf" military transport version

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Military transports of World War II and Korea vintage performed admirably. But today they deserve to be replaced as better air battle-wary veterans.

Typical of such transports is the DC-3—up of the finest, most reliable airplane of today. In use, and ability to land and take off from virtually any military field, made it an extremely flexible transport. It has served faithfully in many roles over the past 20 years and has proved to be an excellent military investment. The Grumman Gulfstream is ready to serve as the up-to-date in military transport for the next 20 years, and as a comparable investment.

In the illustration, right, you see two airplane silhouettes: the first, a DC-3; the second, a Grumman Gulf-

stream. Note how closely they coincide in size. The Gulfstream is the modern passenger, high performance replacement for the DC-3 and other older transports, equivalent to the DC-3 as a work horse transport—and costing even less to operate—the Grumman Gulfstream is a new airplane proved in service by over 60 world-wide corporations and the Federal Aviation Agency. Modernization of our country's airship capacity for land or break for the modern can be accomplished by the Grumman Gulfstream. And it's available now.



Gulfstream compared to DC-3



Passenger inspection

Here are the Gulfstream's capabilities. For military application, it will carry up to 24 passengers and has a transcontinental range against 50-knot head winds. It needs only 3,000 feet of runway, making personnel to use fields close to their destinations. It is completely independent of ground



Air evacuation

loading facilities. With its pressurization system, up to 30,000 feet, a fine above weather and traffic at a cruising speed of 350 mph and is powered by proven turbo-propeller engines. An active development



Multipurpose Gulfstream cabin

program is in progress at Grumman for the installation of the General Electric T56 turbo-prop engine as an alternate source of power.

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AIRCRAFT ENGINEERING CORPORATION
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Airline Income and Expenses—April, 1961

(in \$ MIL.)

	Passenger Revenue	U.S. Mail	Express	Freight	Charter	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNKS								
American	31,045.37	675.30	223.47	1,899.19	—	34,443.49	30,399.57	4,043.92
Southwest	3,729.33	337.32	39.81	186.11	43.76	4,336.49	4,112.17	224.32
Continental	3,119.37	198.17	103.29	123.18	—	3,544.01	3,397.87	146.14
Eastern	4,425.03	84.50	39.20	139.00	54.09	4,741.82	4,499.08	242.74
Delta	12,709.83	221.80	30.00	227.00	—	13,288.63	12,391.09	897.54
Eastern	31,405.70	464.20	—	1,123.61	—	34,144.41	33,511.26	633.15
Norfolk	4,114.84	81.71	36.33	263.44	81.21	4,577.53	4,378.60	198.93
Northwest	—	—	—	—	—	—	—	—
Trans World	38,300.74	431.84	—	1,337.07	106.00	40,175.65	38,111.20	2,064.45
United	25,405.84	1,115.12	—	5,361.10	13,014	45,936.06	42,000.00	3,936.06
Western	1,446.21	82.15	—	147.17	—	1,675.53	1,607.60	67.93
INTERNATIONAL								
American	492.70	3.36	491	10.50	—	987.61	911.86	75.75
Southwest	850.71	15.10	—	18.19	—	874.00	844.49	29.51
Continental	222.23	2.47	—	—	—	224.70	209.30	15.40
Delta	111.20	1.48	—	—	—	112.68	109.00	3.68
Eastern	2,921.47	45.18	—	100.21	—	3,066.86	2,912.10	154.76
Norfolk	15,000	—	693	3.89	—	15,703	15,610	93.00
Northwest	—	—	—	—	—	—	—	—
Trans World	26,403.00	2,091.19	—	5,011.00	1,461.00	34,966.19	30,841.80	4,124.39
United	1,711.20	40.00	—	—	—	1,751.20	1,641.00	110.20
Western	1,303.00	1,171.11	—	1,323.00	—	3,807.11	3,541.00	266.11
Delta	6,117.00	6,600	—	1,130.00	—	13,847.00	12,411.00	1,436.00
Eastern	6,117.00	1,200.00	—	1,130.00	—	8,447.00	7,841.00	606.00
Southwest	1,446.21	45.18	—	100.21	—	1,591.60	1,511.00	80.60
Northwest	—	—	—	—	—	—	—	—
Trans World	31,444	700	—	2,142	—	34,286	31,701	2,585
United	6,117.00	723.70	—	723.70	—	7,564.40	7,041.00	523.40
Western	4,444.44	81.12	—	35.11	—	4,560.67	4,281.00	279.67
Eastern	22,222	2,222	—	2,222	—	26,666	24,444	2,222
LOCAL SERVICE								
American	3,044.70	3.37	14.78	20.74	1,197	5,283.61	4,148.40	1,135.21
Southwest	471.80	2.00	3.10	4.84	—	481.74	444.00	37.74
Continental	355.43	30.41	3.47	11.81	—	400.71	373.00	27.71
Eastern	173.24	15.87	4.60	23.47	—	217.18	201.00	16.18
Delta	493.20	10.48	11.00	9.50	—	524.18	493.00	31.18
Eastern	1,446.21	12.87	32.72	11.72	—	1,503.52	1,384.00	119.52
Norfolk	1,446.21	16.00	21.00	10.10	—	1,583.31	1,450.00	133.31
Northwest	444.44	16.00	15.00	31.00	—	516.44	480.00	36.44
Trans World	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
United	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
Western	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
Trans World	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
United	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
Western	1,446.21	15.00	15.00	15.00	—	1,591.21	1,450.00	141.21
HAWAIIAN LINES								
Maui	306.10	1.02	—	3.00	—	310.12	291.00	19.12
Honolulu	40.44	2.14	—	47.57	—	89.15	82.00	7.15
CARGO LINES								
American	—	—	—	—	—	—	—	—
Continental	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Delta	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Norfolk	—	—	—	—	—	—	—	—
Northwest	—	—	—	—	—	—	—	—
Trans World	—	—	—	—	—	—	—	—
United	—	—	—	—	—	—	—	—
Western	—	—	—	—	—	—	—	—
WILCOX LINES								
Chicago	121.47	120.14	—	—	—	241.61	230.00	11.61
Los Angeles	98.73	4.10	2.14	—	—	104.97	100.00	4.97
New York	—	—	—	—	—	—	—	—
ALASKA LINES								
Alaska Airlines	121.20	35.80	1,400	20.80	209.84	387.64	366.14	21.50
Alaska Coast	64.94	4.10	—	—	—	69.04	64.00	5.04
Central	—	—	—	—	—	—	—	—
Delta	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Delta	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Norfolk	—	—	—	—	—	—	—	—
Northwest	—	—	—	—	—	—	—	—
Trans World	—	—	—	—	—	—	—	—
United	—	—	—	—	—	—	—	—
Western	—	—	—	—	—	—	—	—
Other Airlines								
American	—	—	—	—	—	—	—	—
Continental	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Delta	—	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—	—
Norfolk	—	—	—	—	—	—	—	—
Northwest	—	—	—	—	—	—	—	—
Trans World	—	—	—	—	—	—	—	—
United	—	—	—	—	—	—	—	—
Western	—	—	—	—	—	—	—	—

*Not Available

†Includes Service to Mexico Domestic

‡Includes Carrier's Own Expenses

§Includes Fuel, Lubricants, etc.

*Operations Suspended

†Includes Other Transport Services

‡Includes Fuel, etc.

§Includes Fuel, Lubricants, etc.

*Not Profit or Loss

†Includes Other Transport Services

‡Includes Fuel, etc.

§Includes Fuel, Lubricants, etc.

*Passenger

†Includes Other Transport Services

‡Includes Fuel, etc.

§Includes Fuel, Lubricants, etc.

BSE

PHOTO BY P. H. LLOYD LLOYD PUBLISHED BY BRISTOL SIDDELEY ENGINES LTD. PHOTO BY P. H. LLOYD LLOYD

5 of the world's foremost jet trainers selected for the air forces of 5 countries...

...AND BRISTOL SIDDELEY SUPPLY THE POWER

One of the largest manufacturers of motive power units in the world, Bristol Siddeley Engines Limited produce the very successful Orpheus and Viper turbojets.

These engines power many different types of production aircraft, ranging from strike fighters to target drones. Specially adapted versions of the Orpheus and Viper have been developed to meet the stringent requirements of the new generation of jet trainers, and now power 5 of the world's foremost jet training aircraft which have already been selected for the air forces of Britain, Germany, Italy, Japan and Ceylon.

Manufacturing licence agreements for the Orpheus have been signed with France, Italy, India and Germany, and for the Viper with France and Italy.

BRISTOL SIDDELEY ENGINES LIMITED



POWER FOR THIS

The Bristol Siddeley Industrial Process gas turbine engine drives a 3,000 kilowatt turbo generator. Designed for peak output and stand-by power, this new product power station, one of which are in service, drives full power while 2 minutes of a cold start for a lower output cost than any other comparable type of gas turbine.



... AND THIS

Bristol Siddeley Maybach diesel engine powers India's stock exchange trade—the Bristol Maybach "Ditchburn". Two Type 31D 630 engines, developing a total 9,000 hp, give the "Ditchburn" a top speed of 80 mph (64 Bristol Siddeley Maybach diesels have been ordered by British Railways).



... AND THIS

The Bristol Siddeley Orpheus turbojet powers the Hawker P.1127 strike aircraft—the world's first VTOL jet aircraft designed for operational service. This jet is applied through four variable moduli evenly disposed around the intake of gas jet, providing a single power source for all conditions of flight.

Bristol Aero Industries Limited, 10001 Park Road, Weybridge, Surrey, TW20 2EX, England

AIRLINE OBSERVER

Domestic airlines' revenue passenger miles continued to decline in May to reach the lowest monthly figure recorded for the industry since March, 1968. Total of 23.84 million revenue passenger miles registered in May was 2.6% below the volume handled in May, 1968. At the same time, available seat miles rose 5% to disprove the industry's lead factor by 4.3 points. May's lead factor of 54.66 is one of the lowest recorded by the industry in recent years.

Russia has agreed to start talks with the U. S. on a bilateral air transport agreement covering reciprocal traffic rights on a New York-Moscow route. U. S. has suggested July 18 as an opening day for the negotiations. Meanwhile, Pan American World Airways, outbid to operate the route, is financing Russian language courses for selected members of its staff. The carrier sometimes, however, that it has set no target date for the opening of a Moscow office.

LDT, the Polish airline, has opened a sales office in mid-town Manhattan. The first service based behind the Iron Curtain to establish a U. S. sales office. The airline plans to begin transatlantic service "eventually."

Federal Aviation Agency is conducting Project Little Guy to draft standards for strengthening the designs of light aircraft to protect pilots. Development of standard instrument and control configurations, which may be mandated to achieve noise-transport concepts, is a major goal of the project. FAA Administrator N. E. Halsey has asked the Project Little Guy study group to report in June 37.

Continental China claims to be making regular flights over a route network of about 27,945 mi., compared with about 21,000 mi. at the beginning of 1968. New routes opened during May included one to 1,861 mi. and included Kowloon, Chongqing and Beijing-Kowloon. Red China reports a 50% gain in over 20 domestic air traffic during 1968.

International Civil Aviation Organization is considering an increase in the size of its council, now composed of 23 states elected for a three-year term to serve as ICAN's governing body. ICAN has grown from 26 states in 1947 to a current 46, and a number of nonmember countries that a council limited to 32 members no longer guarantees adequate participation.

Japan Air Lines will phase out its three Convair 440 turboprop transports in domestic service beginning in August. The aircraft was in use, but operated on the southern route to Europe, but opening of this route has been delayed indefinitely. The two remaining Convair 440s will serve the northeast Asia route. Domestic service will include Tokyo-Sapporo and Tokyo-Fukuoka routes.

Three 150-high reproductions of Scottish whisky bottles have been mounted as an advertisement in front of the London Airport terminal and this is the initial section in Parliament, as reported by Hansard, the official recorder.

"Mr. Chatterfield asked the Minister of Aviation why he opposed the large advertisement for whisky manufactured in front of the main terminal building at London Airport."

"Mr. Thompson: for none."

United Arab Airlines, national airline of the United Arab Republic, is scheduled to fly the Vickers VC-10 transport for its proposed trans-Atlantic routes to North and South America. First goal is a route to New York via London. Once operating rights are obtained, the airline will use Convair 440s on the route until the VC-10 is available.

Radio radio station WEEZ is reporting delays of more than 60 min. on all airline flights departing out of Logan Airport. The report is broadcast every hour on the hour.

Export-Import Bank has approved a loan of \$6.3 million to help Air India purchase two Boeing 747s. India will finance 74% of the \$18.5-million purchase and The Boeing Co. will lend the airline \$1.4 million.

SHORTLINES

Athlisis, the Balkan airline, has begun Douglas DC-8 service from Rome to Sydney, Australia, with one flight a week stopping at Tehran, Karachi, Bombay, Bangkok, Penang, Cebu, Manila and Darwin. The new service extends the Athlisis Far East route 6,500 mi. from Istanbul to Sydney and replaces DC-7C service.

Domestic Air Lines reports a 27% increase in revenue passenger miles for May and a 21% increase in revenue passenger miles for the first five months of 1968 over the same period last year.

British Overseas Airways Corp. reports it carried 794,718 passengers during the first year ending Mar. 31, an increase of 12.9% over the previous fiscal year. British Overseas Airways carried 1.9 million passengers during the same period a 21.3% increase.

Civil Aeronautics Board has approved a Caribbean Air Transport Agreement containing the present eight rates in the Caribbean area for an indefinite period.

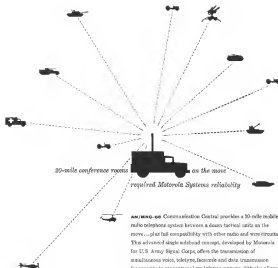
Delta Air Lines reports a 28.1% increase in Florida traffic during the period between December and April despite a generally slow March season for service. This month, Delta is offering 543 daily seats in and out of Miami, up from 544 seats last June.

Federal Aviation Agency has begun using DME (Distance Measuring Equipment) procedures on a nationwide basis for the Hawaiian Airlines air fleet—the first carrier to be entirely equipped with DME (AW Apr. 3, p. 16).

Lockheed reports its Florida turbo-prop aircraft serving 14 airlines have logged a total of 408,000 hr. Eastern Air Lines logged the most flight time with 215,435 hr.

Northeast Airlines has installed the V-D-1 teletype system in its new office at Minneapolis-St. Paul International Airport. The system will relay sales, traffic and other information to major non-Northeast offices through out the U. S. except centers off main West Coast cities. If the teletype line is busy, the equipment stores the message until the line is free.

Pacific Southwest Airlines and Western Air Lines have been granted a 20% by mutual extension to 1,500 hr. by Federal Aviation Agency for the QSO 501-D11 engine, powering their Lockheed L-1049.

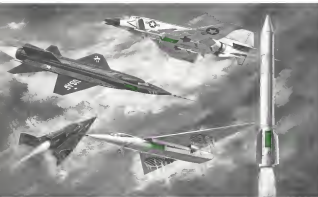


ANIRMO-60 Communications: Central provides a 30-mile mobile radio telephone system between a dozen tactical units on the move... plan full compatibility with other radio and wire circuits. The advanced single subband concept, developed by Motorola for U. S. Army Signal Corps, offers the transmission of simultaneous voice, teletype, facsimile and data transmission far superior to conventional modulation systems. It also allows more channels in a given portion of the crowded RF spectrum, and more systems in a given area. It Automate Output Central ensures uniform signal reception regardless of whether vehicles are deployed 500 feet or 10 miles from the Central. Three operating modes—Normal, In-Channel Net and Emergency Net—enhance the basic system flexibility. A simplification inherent in Motorola's concept and modular design affords the highest possible degree of reliability and maintainability in the field. Detailed information is available on request.

Military Electronics Division **MOTOROLA**

Qualified technical personnel
are wanted to apply

CHICAGO 91 (Bldg.) 1400 North Oakview Avenue
SCOTTSDALE, ARIZONA 85201 East McDevitt Road
SPRINGFIELD, OHIO 45502 2000 South Main Avenue



GESAC

New flight control system
is fully self-adaptive,
performance-proven in
flight testing

A whole new flight spectrum of manned and unmanned vehicles is at hand. To meet the unique range of control requirements of these vehicles, General Electric now offers a completely new type of flight control system, called GESAC (General Electric Self-Adaptive Control).

A knowledge of the detailed aerodynamic characteristics of a missile or aircraft is not required to apply GESAC to the vehicle. Thus, both flight testing and application engineering effort can be sharply reduced.

No external air data sensors or computers are required for gain changing.

GESAC has already been successfully flight tested aboard the Grumman P-126 under Navy Bureau of Weapons sponsorship. An evaluation of extremely rigorous test profiles has been conducted on the North American X-15B under Air Force contract, with outstanding success. A flight evaluation on the McDonnell F4S-1 is currently in progress under Navy BuWeps contract. GESAC provides another example of Light Military Electronics Department leadership in aerospace electronics.

GENERAL ELECTRIC

Light Military Electronics Department
Armament & Control Section, Johnson City, New York

AERONAUTICAL ENGINEERING



NOGGERP of the Sud TE10 Super Frelon helicopter on order by West Germany and the French army shows its six-blade main rotor configuration and new stage loading wing. As a stage vehicle, TE10 would transport two small military type vehicles at its cabin over a range of 375 and km. As a troop carrier it would accommodate 27 troops.

Super Frelon Offers More Speed, Payload

By Cecil Browder

Paris—Sud 3216 Super Frelon designed to help all the West German and French army heavy tanking helicopter units represents a major step beyond the two predecessor 1200 Frelon prototypes now rounding out their flight test evaluation. GECASAT plans to order 150 3216s (AW June 24, p. 34).

Differences between the two models should even aspect of design, ranging from fuselage construction and positioning of fuel stores to rotor configuration, payload speed and engine power. Evolved design changes include:

- Incorporation of six-blade main rotor system capable of handling higher gross weights in a substitution for the four-bladed rotor installed on the 1200 prototypes. Diameter of the Super Frelon main rotor system is 67 ft as opposed to 49.2 ft for the 1200. Other advantages of its main blades include the ability to attain higher forward and reverse speeds as well as lower stall speeds because of the reduced angle-of-attack needed in forward flight.

Blekins, Aircraft Division of United



FOUR-BLADE PROTOTYPE of the earlier 3200 Frelon, predecessor of the 3216, demonstrates its maneuverability in Pan Am show style. Unlike the 3216, the 3200 carries all its fuel externally in tanks mounted to each side of the fuselage. Two prototypes of the 3200 have been built and are under test.

Aircraft Corp., which began testing the variable-rate variable function engine a modified S-66, is working closely with Ford on a technical assistance level in the Super Falcon program. Sikorsky S-64 Flying Crane, first prototype of which is scheduled to roll out early next year, also will use the variable-rate engine system.

• **Substitution of fixed-blade tail rotor**—with a diameter of 12.5 ft. to replace the four-blade system on the S200, which has a substantially smaller diameter.

• **Increase in maximum speed** to 195 mph. from about 131 mph. for the Falcon and a boost in cruising speed to 157 mph. from 124 mph.

• **Expansion of maximum gross weight** to 25,500 lb., normal gross to 24,790 lb., as opposed to 17,000 and 16,550 lb. respectively for the S200. Maximum gross weight of the S-66, which also is scheduled to be used by the West German military, is 18,990 lb. Empty weight of the Super Falcon is 15,200 lb.

• **Placement of fuel tanks** within the fuselage below the floor level. Fuel for the S200 is carried externally in tanks mounted to each side of the rotor. Super Falcon has three standard internally-located fuel cells capable of holding 760 U.S. gal. each, and additional tanks can be housed in the fuselage for ferrying purposes.

• **Adaptation of three Turbomeca Yermac HC shaft turbine engines** of 1,528 shp each and a growth potential to 1,840 shp for the Super Falcon. Turbo S200 gas turbines are powered by three Yermac H10s of 900 shp each. In both instances, two engines are located side-by-side in front of the gear box above the rotor, the third behind the gear box. To increase the growth potential possibilities of the S200, the

Super Falcon transmission, gears in being built to handle a maximum of 3,100 shp (as continuous power) and 1,600 shp for takeoff.

• **Use of an amphibious landing** feature on the S200 to meet new requirements as opposed to the standard fixed body of the S200.

In keeping with its increased maneuver and annual gross weight, the Super Falcon will be capable of ferrying 27 troops or 15 litter patients plus two attendants as opposed to the 24 troops or 15 litter patients and attendants of the S200.

Maximum sea-level range of the S200 Super Falcon is a normal gross weight of 24,790 lb. carrying a full 370 gal. of fuel at takeoff is 495 mi. or with 10 men aboard. As a cargo carrier the S200 can transport two jeeps weighing a total of 6,000 lb. over 124 mi.

• **Rated for self-sustenance** duty, with a dipping mast unit lowered from its landing within the cabin and with a tarpaulin located on either side of the fuselage, the Super Falcon has a search capability of 3 hr. with 30 day reserves when operating within a radius of 40 mi. from its home base. Operating at a radius of 160 mi. or from its base, the S200 can operate in the search area for approximately one hour. Both features enhance the helicopter taking off at its maximum gross weight of 25,500 lb.

In full auxiliary configuration equipped with a boat system, the Super Falcon can carry a maximum load of 9,000 lb. Normal lift rate of the boat system is one foot per second.

Maximum length of the Super Falcon with blades folded is 55.7 ft. at compared with 48 ft. 10 in. for the S200. Super Falcon width with blades folded is 17.2 ft. or about 2

ASTRONOMICAL SATELLITE



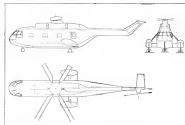
National Aeronautics and Space Administration's Astronomical Observatory will be launched 500 miles into space in 1965. It will orbit above the clouds of Earth's atmosphere, which obstructs and absorbs radiation from stellar objects. Observations through a 36 inch telescope from the vantage point will provide astronomical data unavailable from any ground-based equipment.

Orbit Stabilization. Within five hours after reaching orbit, the Astronomical Satellite's stabilization and control system will eliminate tumbling and roll, and orient its optical axis away from the sun. Reference to a predetermined star pattern will verify orbit stabilization.

Accuracy Stabilization. Next, the satellite will be pointed and held to within 1.0 minute of arc, using feedback from the system's six star trackers. Feedback from experimental optics will then be used to stabilize the satellite within 0.1 seconds of arc.

General Electric's Missile and Space Vehicle Department is developing the stabilization and control system for the Astronomical Satellite. Similar systems for Atlas and Thor reentry vehicles, and Advent and Venture satellites have already been designed by MSD. A department of the G.E. Defense Electronics Division.

GENERAL ELECTRIC



SUPER FALCON is 55.7 ft. long, 17.2 ft. wide and 16.2 ft. high with rotor blades folded. Rotor is 42 ft. in dia. Cabin is 6 ft. high, 6.2 ft. wide, 22.9 ft. long.



LIGHTWEIGHT FIGHTER WITH

Here is the Northrop N-156... a bold new concept in fighter weapon systems

The twin-jet supersonic Northrop N-156 is more than an aircraft; it is a complete family of lightweight fighter weapon systems designed to fulfill the many air support roles of limited war: close support of ground forces, reconnaissance and surveillance, interdiction, air defense and air superiority. The N-156 can be deployed from the United States zone of interior to any point in the world within 24 to 48 hours. It can then be dispersed throughout the theater of operations, utilize advance bases with short, unimproved runways, and operate with minimum

logistic support, fast turnaround and extremely low maintenance downtime.

Its high performance, extreme maneuverability and ease of handling have won the Northrop N-156 unanimous acclaim as a "pilot's airplane." An exceptionally safe and reliable aircraft with unusual aerodynamic stability, it can accomplish its mission, return and land safely with one engine out. Very low fuel consumption eases the storage and resupply problems likely to plague advance areas. Maintenance and service can be easily accomplished from ground level without

A HEAVYWEIGHT PUNCH

designed specifically for limited warfare... ready now.

crew stands. In short, from both a tactical and logistic point of view, the N-156 is ideally suited to the mission requirements and problems of limited warfare.

The economics of the Northrop N-156 are also highly favorable for limited warfare. Low initial cost plus exceptionally low operating and maintenance costs make it possible to greatly increase the number of units in the field for the same budget dollar. Simplicity of maintenance also reduces the number of trained personnel, the amount and complexity of ground support equipment needed in

the field. The result is an extremely flexible force, able to respond effectively to pressures anywhere in the world in the shortest possible time, and with minimum dependence on the difficult supply posture likely to prevail in remote areas.

The Northrop N-156 has been flying since July 1959. It is a developed weapon system, ready for immediate production. Deliveries can commence in just 14 months.

NORTHROP
NORTHROP CORPORATION, BEVERLY HILLS, CALIFORNIA



Patrouille de France, French air force acrobatic team, led by Capt. Jean Pons, displays the triangle and white and blue paint scheme on their Dassault Mystere IV supersonic fighters in formation flybys at the 24th Paris Air Show at Le Bourget. Note low pass in the 12 plane formation taking out of position.



French Acrobatic Team Performs With Mystere IVs

Patrouille de France pulls up into formation loop (above) with its 12 plane formation trailing red, white and blue smoke to form the French tricolor. One plane is shown obscured by the smoke trails. Group also did formation rolls. In a tight

acrobatic formation (left), the Patrouille de France led the crowd of 250,000 on the final day of the flying exhibition.

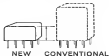


Mystere IVs each preceded by a Heugon Venturin towlight, climb over the top to start their inverted bomb burst (above) as the finale of their Paris Air Show performance. The French team, composed of volunteers from the Second Escadre of Dijon, pulls out of its formation loop taking tricolor smoke (below).



NEW LOW PROFILE

IN LEACH HALF-SIZE CRYSTAL CAN RELAYS



Less than half the height, same base dimensions! Leach's new M-350 half-size crystal can relay delivers a 50% space and weight economy for printed circuitry, but fits the same base configurations (300 inch grid terminal spacing) as standard subminiature crystal cans.

Now design engineers can greatly reduce the size of printed circuit packages because three of these new vertical self-assembling M-350 relays can be used in the same space required by a single conventional crystal can with its leads bent down for soldering.

Normal and operating voltages..... 0 to 50.6 VDC
 Gasket rating @ 50.6 VDC..... LOW Level to 2 Atmos
 Life @ rated loads..... 100,000 cycles

Write today for further information and specifications on the M-350 series... less sensitive to vibration from service it's smaller than other relays... more reliable because it contains a single and electro-mechanical correct instead of two coils.

**LOOK TO
LEACH**

LEACH CORPORATION, 16405 Surridge Road, San Jose, California
 EXPORT: Leach International, S. A.

Advertising Boosted For Soviet Exports

Moscow—Russia's Autodisplay organization is expanding and diversifying its advertising coverage in an effort to boost aircraft, automobile, truck, tractor and other vehicle sales in non-Communist countries.

A color Russian poster on the four-rotorship B-15 is prominent in among those with flies scheduled for release this year by the Soviet export monopoly. Consequently will probably be in English, French, German, Spanish and Arabic.

Foreign language plane's advertising both the B-15 and Ka-15 helicopter have been prepared "as an experiment in this type of publicity." Long-term program of Autodisplay's advertising department calls for greater participation in international exhibits and fairs and sponsored "consultations" displays, establishment of additional permanent exhibits in selected foreign trade centers and a large increase in printed sales and promotional literature.

Sonic Barrier Crashes Revealed by Russians

Moscow—Details of Russian jet aircraft catastrophes which occurred during the Soviet attempt to crack the sonic barrier following World War II are just being revealed to the public.

Material on the subject is contained in a new book, "Through Inaudible Barriers," by test pilot M. I. Galka.

Galka tells how "several" Soviet jets "came apart in the air from the sudden displacement of vibration at high subsonic speeds." Among those "who fell owing to better" in the MiG-9 first Soviet jet fighter was A. N. Gerasimov, who made the aerial flight in the two-engine craft.

Russian citizens' interest in the long-postponed tests of Soviet jet aviation development is so intense that the entire 15,000 copy printing of Galka's book "disappeared from store shelves automatically."

Soviet Space Chief

Konstantin N. Rabush has been appointed chairman of the Soviet State Committee for the Coordination of Scientific Research, the top cosmic and space post in the USSR.

Rabush, promoted from his former post as chairman of the Council of Ministers for Defense Technology, succeeds M. V. Keldysh, who died earlier this month (AV June 12, p. 16). Leonid Serov replaces Rabush in the defense post.



Known to rust hawks a hundred times his size, the horned lark is a creature of courage. But when he takes this risk, it is with a distinct advantage. His powers of flight are matched by none.

We admire his style. And we share the philosophy. Knowing that our own capabilities are highly distinctive, we too believe that they are a thing to be used with boldness. Two years ago, Fairchild pioneered commercial production of different silicon MOS transistors. They became the industry's most widely copied types. But we developed direct replacements—silicon PLANAR transistors (PLANAR diodes too were developed)—another step forward. Our newly introduced PLANAR EPITAXIAL devices and MICROLOGIC elements continue the progress.

We have many ambitious programs ahead. If you like our approach and have a relevant background, we would like to hear from you.



360 WHISMAN ROAD • MOUNTAIN VIEW, CALIFORNIA
 A Division of Fairchild Camera and Instrument Corporation

Photo from the book "FAIRCHILD'S BEST" by C. H. Greenleaf. © American Museum of Natural History.

ALCOA CAPABILITY AT WORK...

Switch to die forging...

cuts wing spar forged weight by 895 lb



ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA



AW 660 Makes Paris Flyby

Antonov Whitehawk AW 660 GML 1 on RAF Transport Command meetings stage low level flyby at Paris Air Show with eight antihelicopter fuel-tank and chemical stores in open, lightning position. The AW 660 36 of which have been ordered by RAF, is only very version of the AW 650 Agave freighter operated by KLM's Aerlines. Note navigation antenna located on forward belly of the aircraft.

X-15 Pilots Win Harmon Trophy

Winners of the Harmon International Aviation Trophy are A. Scott Crossfield, Joseph A. Walker and USAF Maj Robert A. White. Award was in recognition of their accomplishments in flying the rocket-powered X-15 to research vehicle during 1968.

Crossfield was the first pilot to set pace March 2 in the X-15. He is development engineer and second test pilot for North American Aviation. Walker obtained Mach 5.31 on Aug 4, 1968 in the X-15. He is chief engineering test pilot and a physicist of the National Aeronautics and Space Administration. Maj. White, USAF, on Aug. 12 climbed to 136,500 ft in the X-15 research vehicle.

The Harmon Trophy, established by the late Col. Clifford B. Harmon, aviator and ballplayer, is granted for outstanding achievement in aeronautics, particularly associated with scientific experimentation and research which is of world-wide importance.

This year marks the fifth year three pilots were named as joint winners. Presentation of the award to the three winners will be made by President John F. Kennedy in the fall.



Paris Spaceman

Space aluminum selection Tony W. M. M. Alford's innovations and modifications to the series at 245 Paris International Air Show. General work was done at TWA's Research Lab. TWA's regional director of public relations-international.

Vanguard 2 VTOL To Begin Hover Tests

Vanguard Aer & Marine Corp., Park, Pa., will conduct further hover and wind tunnel tests of its Model 1 Overpressure VTOL aircraft under Air Force Systems Command contract. The four-engine vehicle has completed wing modifications and installation of a 324hp Lycoming T53 turboprop engine. The vehicle drives vertical lift from ducted wing fans and thrust from a conventional propeller.

SWITCH TO DIE FORGING... CUTS WING SPAR FORGED WEIGHT BY 895 LB

Originally hand-forged shape, this 175-ft wing spar forging weighed 1,690 lb. Alcoa called upon its vast resources of experience and facilities to find a better method of fabrication. Alcoa's capability broke the back of the problem. The solution: die forging. Utilizing advanced techniques considered impossible only a few years ago, Alcoa will forge the part on its 30,000-TON PRESS. The pay-off will be considerable: an estimated 600 hours saved in machining time... and weight of the forging cut to 305 lb. This breakthrough by Alcoa will pay an additional dividend to the aircraft designers by opening the door to greater design flexibility.

The die forging of this huge wing spar is a significant example of Alcoa capability at work. Alcoa... where the men, the metal and the machines can forge, extrude and cast the solution to your metal problems. How can we help you use this capability? Write: Aluminum Company of America, 1870-T Alcoa Building, Pittsburgh 16, Pa.



ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA



Dark streamlined shapes under Mirage IV A show wing air fences covering control surface hinges and actuators.

Weapons, Radar Systems Shown On Mirage IV A

Generalis Aeronautique Marcel Dassault's Mirage IV A prototype, shown at this year's Paris Air Show, is planned to soon deliver nuclear warheads for French nuclear-weapon strike force. Powered by paired Senecca Avon 9 turbojets rated at 13,215 lb thrust, the plane has Mach 2.45 performance, and about 2,800 mi range. Fifty of the aircraft are scheduled to be operational by 1968.



Serviced trains protrude in leading edges help control flow over delta wing.



Navigation radars (dark oval), streamlined weapons bay are distinctive features of Mirage IV A. Inlets have variable geometry.



Distorted photograph shows re-entry of ballistic missile complex. The Bendix photoelastic laboratory is for simulation of re-entry phenomena.

DISCRIMINATION among re-entry objects is the key to an effective and economical defense against ICBM's. Through four years of Army and ARPA sponsored Investigations under the direction of the U. S. Army Rocket and Guided Missile Agency, Bendix has been engaged in research projects on the prediction, simulation and verification of the re-entry behavior of ICBM target complexes. These data are prerequisite to successful system synthesis. Senior engineers experienced in this field are invited to join the Bendix team.

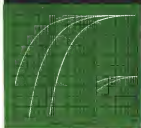
Qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

BENDIX SYSTEMS DIVISION

ANN ARBOR, MICHIGAN



EVERYONE TALKS RELIABILITY IN HERMETICALLY SEALED CONNECTORS BUT ONLY CANNON OFFERS STATISTICAL PROOF



The Cannon KPT Hermetic line is designed to, and has surpassed all requirements of MIL-C-28402. It has proven statistically reliable in leakage tests 999 times as severe as that required by MIL-G-64482. Cannon offers you hermetic seals with a reliability coefficient of .999 at a confidence level of 99%. Our rigid manufacturing controls and continued testing guarantee reliability also added cost—and, in many instances, at lower prices than ordinary hermetic seals. Available for off-the-shelf delivery from Cannon stocking points and CAPS Distributors throughout the United States. **LEAD-FREE COMPRESSION GLASS • EXCEPTIONALLY LEGIBLE CONTACT IDENTIFICATION FOR FASTER**

TERMINATING AND CHECKOUT • RELIABILITY ASSURANCE SUBSTANTIALLY REDUCES THE NEED FOR USER'S VERIFICATION TESTING • These are only a few of the many reasons why you should consult the world's most experienced manufacturer of electrical connectors for your hermetic sealing needs. For immediate delivery and quotations write, phone or visit Customer Services Manager, PHOENIX DIVISION, 8601 AIRLARK PHOENIX, ARIZONA. Phone BRIDGE 5-4792. Test report and complete KPT Catalog available upon request from:

**CANNON
PLUGS**

CANNON ELECTRIC COMPANY, 3306 Humboldt Street, Los Angeles 31, California



North American A311 with leading and trailing edge flaps deflected, lifts off runway to start demonstration. Flap between exhaust and slats of two General Electric J79-GE-7 turbojets is gill-like—having opening for more air despite deflection of slats.

U. S. Attack Aircraft Perform at Paris Air Show



McDonnell F4H lives up to itself with full-span leading-edge flaps down. Pilot has boundary-layer control on wing leading and trailing edges. Spoilers and airbrakes are retracted instead of deployed. Top: Stabilizer shak-bait has large inboard to increase deceleration at supersonic speeds. Inlets for two GE J79-GE-7 turbojets have variable geometry.



Republic F105 stresses braking chute after touch-down. Post-speed brakes at sides of Pratt & Whitney J75 turbojet are open.

SHILLELAGH

U.S. Army Missile System



The SHILLELAGH is being developed for the U.S. Army under the overall direction of the U.S. Army Ordnance Corps.

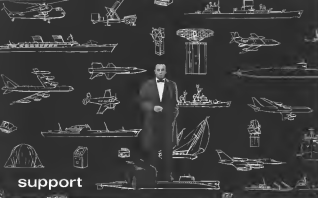
The United States Army SHILLELAGH surface-to-surface guided missile—like its Irish namesake—will be simple, reliable . . . lethal. Against enemy targets—moving or stationary—SHILLELAGH's accuracy and firepower will provide the U.S. Army a devastating new weapon that kills with a first-round probability approaching unity . . . and at ranges never achieved in antitank warfare. SHILLELAGH is now under development at Aeronutronic, prime contractor on this advanced weapon system.

AERONUTRONIC DIVISION *Ford Motor Company*, DEFENSE PRODUCTS GROUP
4080 ROAD, NEWPORT BEACH, CALIFORNIA



SHILLELAGH is one of many advanced programs currently under development at Aeronutronic's new, million-square-foot Engineering & Research Center in Newport Beach in Southern California.

Write for information about Aeronutronic's capabilities and career opportunities now open for engineers and scientists.



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T-shaped microwave receiver communication system recently installed at Fairchild AFB, Wash., provides radar and data channels to all active Atlas missile launch sites (left). Central microwave station (right) and those at individual launch sites, are housed in underground concrete-filled bunkers except for antennas which are mounted on concrete pillars and enclosed in tough plastic cover.



Rugged Communications Link Atlas Sites

By Philip J. Klein

Atlas ICBM launch sites, dispersed over an 8,000-sq.-mi. area at Fairchild AFB, Wash., have been linked to an underground command-control center by means of a hardened microwave communications system designed to withstand bomb-blast overpressures up to 25 psi. (The term "hardened" usually is applied to facilities capable of withstanding overpressures of 100 psi or more.)

The new microwave installation, built by Collins Radio Co., has automatic fault sensing and re-routing provisions intended to assure that Strategic Air Command has positive missile launch control despite equipment malfunctions, sabotage or blast damage to one or more stations in the system.

The only elements of the Collins system located above ground are limited diameter microwave antenna dishes, mounted on concrete thick high-strength plastic domes which are fastened to rock walls. The remainder of the equipment—transmitters, receivers, modulators and switching—is housed in concrete-filled bunkers that are buried 20 feet underground (see photo at right).

For communications with underground launch sites at area hardened Titan II bases, Air Force plans to use UHF or VHF radio and voice with hard-wired connections to alert controllers for the work. Although UHF/VHF radio holds the promise of recovery, it has the advantage that the network required is smaller and less costly because it is situated underground for

protection when needed. Microwave surface antennas could be designed for similar operation, but again require those above the ground it would be necessary to dig them with moderate persistence with distant station antennas. For command and control of deep-buried Minuteman launch sites Air Force is trying to make earth-conducting communications because of its security and relative immunity to jamming. In a system under development by Sperry, radio waves are transmitted over a wide range of frequencies and detected at the receiving end, a technique known as "spread spectrum."

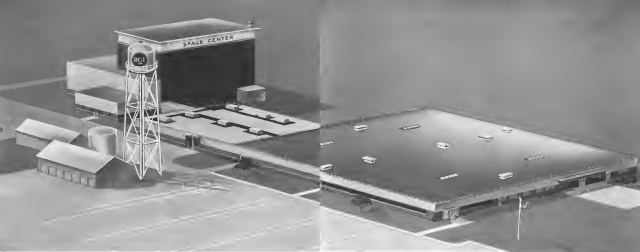
The Minuteman launch control sys-

tem is referred to as "shallow earth currents" because the graphite antennas are buried only a few feet below the ground. Its induced waves travel upward to the earth's surface and along the channel formed by the earth's conductive medium and the atmosphere in a nonconducting medium thus dependent on the receiving antenna. Possibility of this technique was established in tests conducted by Space Electronics Corp. in 1959.

Another technique, known as "deep earth currents," makes use of geological structures which function as wave guides for RF energy. One is a few



MICROWAVE EQUIPMENT, built and installed by Collins Radio, employs modulator plug-in construction to facilitate maintenance and repair, and to permit future expansion if needed.



New RCA Space Environment Facility Brings Outer Space Down to Earth...

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RCA expands its proved capability to meet the challenges of space-age technology with the construction of an advanced space environment center at Princeton, N. J. Here, today's and tomorrow's space vehicles and satellites can undergo a new degree of intensive and thorough testing prior to "launch" to assure greater reliability in space.

Included in the new environmental equipment and facilities being built and installed at the RCA Space Center are the following advanced testing devices:

Vacuum-Thermal Chamber—measuring 28 feet in diameter and 29 feet high to accommodate the coming generations of space vehicles and satellites and meet all vacuum-thermal requirements.

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varied from -65°F to 250°F , humidity from 40 to maximum.

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The only RCA Space Center, which contributed to the success of projects such as SCORE, TIROS I, TIROS II and ECHO L continues to be dedicated to the development, development and production of earth satellites, space vehicles and ground support and information handling equipment. For additional information about RCA's engineering talent and proved capabilities, contact the Manager, Marketing, RCA Space Center, Box 400, Princeton, N. J. And, for a complete description of the new environmental facilities, write for your copy of the brochure "RCA Space Environment Center."

If you are interested in participating in the challenging opportunities that exist at the RCA Space Center, contact the Employment Manager, Astro-Electronics Division, Defense Electronics Products, Princeton, N. J. All qualified applicants are considered regardless of race, creed, color or national origin.



New advanced Vacuum-Thermal facility shown in model has pumping system that can reduce pressure to 5×10^{-6} torr in 24 hours with a 2500 pound payload in the chamber.



New Vibration System will handle 20,000 pound payload driven by an amplifier capable of delivering 100 kW over a frequency range of 20 to 10,000 cps.



All testing environmental equipment will be tested here and a new high bay assembly area provides facilities for assembly of no longer than 10 foot spool.



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An experimental model ESAR radar which demonstrates the fundamental aspects of electronically-steerable array radar is now undergoing test at Bendix Radio. The successful culmination of this experimental effort could provide the basis for a new technology leading to the development of multiple function, electronically steerable array radars capable of searching, tracking, deep space communications and extended control. ESAR is part of Project DEFENDER, the program of advanced research in ballistic missile defense directed by the Advanced Research Projects Agency, Department of Defense. The ESAR contract is administered by the Rome Air Development Center of the U.S. Air Force. Organizations working on advanced space concepts are invited to contact Bendix Radio for details, and to see ESAR in operation.

Bendix Radio Division

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wet conductive layers. Anodes, mill droops, in the crystalline growth and healthy rock structure.

At the recent Global Communications Symposium in Chicago, Raytheon's Gregory J. Herman reported that company tests, under Air Force sponsorship, had demonstrated reliable propagation through rock strata over distances of up to 18 mi at radio frequencies of about 300 kc, using radiated power of 100 watts. Herman said that Raytheon hopes to increase range to 50-100 mi during the coming year at frequencies of 15 kc to 40 kc. The deep strata radio wave propagation which the signals within the earth, penetrating great peaks and basins from outer and some Herman reported.

The Collins system installed recently at Fitchfield AFB provides each voice channel to and between each Atlas launch site, as well as command and control functions circuits which loop the control center advised of the ready status of each site.

The Atlas launch sites are located around the perimeter of an elliptical shaped area which measures approximately 100 x 50 mi with an under ground extensive control station situated roughly at the center. To provide maximum flexibility and reliability, the individual launch site microwave stations are connected into three common network loops.

- East loop, containing approximately half of the individual launch site stations.
- West loop, containing the remainder.
- Interconnect loop, which links all of the stations.

Under normal operating conditions, the Collins system provides two radio frequency paths from the central control center to a relay station, located at one of the two intersections of the east and west loops. The relay station trans-

mits paths to the east loop and the other to the west loop. Each subsequent microwave station in the individual loops, in addition to handling traffic in and out of its own launch site, also serves as a relay to the next site in its loop.

If one or both of the RF paths from the control station should be disrupted, the circuits automatically are switched to another antenna, facing in the opposite direction which naturally eliminates communication by means of a second relay station located at the other intersection of the east and the west loops.

If a circuit disruption should occur somewhere along the east or west loop, power to an individual launch site station from acting as an intermediate relay for its adjoining station, then as further microwave communications in radio traffic in both directions around the "back" loop using both of the main relay stations.

The interconnect loop, consisting of all of the site stations in both east and west loops, provides means and also interconnects between both loops and makes available a small number of highly reliable circuits between all points of the system, according to Carl Lee Rife.

It then should be an interruption of normal circuit routing, automatically using circuits in the required in which are operations as well as switching in and adding fault status at the control center. The existing switching action is in fact no more than 0.01 seconds that even might not otherwise times that on outage has occurred.

The present system has the capability of providing 480 voice channels (16 to 1600), although this number is not now in operation. If needed the system can be expanded to provide up to 600 voice channels, Collins says. Multiple channels are provided by frequency division multiplexing.

Dual frequency division is employed for each of the RF paths with regard to providing to provide separate paths and a constant to being them can be delivered using only a single operating frequency.

The microwave transmission and receivers are stable which permits the use of a common time scale and improves with no evident aging conditions according to Walter Wozniak of the company's Test Division which produced the system. Wozniak says, in the independent backup are installed in the system designed to check means by which there is any possible check, transmitted through the earth.

Each of the microwave stations in the system is equipped with a dual-channel backup system which can provide any of the system's 480 voice paths to the system should be disrupted.

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The above pictured actuator is used in a ground relay system. It is driven by a single phase 60 cycle ac fractional hp electric motor and can be furnished with a feedback potentiometer for use in servo applications. The entire unit weighs only 2 1/2 lb. and is rated at 200 lb. operating load.

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Microelectronic Computer

Microelectronic digital computer module development by the research and development division, is expected to reach less than 15 ft and weighs less than 40 lb. by the next year. New computer is a part of the company's program in making electronic under Air Force sponsorship. The company is developing microelectronic computer under ESAR sponsorship.



"Cat's Eyes" for the Navy's Intruder

The Grumman carrier-based A-7F Intruder is as elusive, low-flying aircraft that can follow a course around hills and other hazards as it sweeps in toward its target. The pilot "uses" his course and target clearly even in midnight darkness... or in spite of severe weather conditions... by Norden's Search and Destroy Clearance Radar.

This system, serving as "cat's eyes" for the Intruder, provides an electronic display of information supplied by advanced sensory equipment. Two viewing screens in the cockpit enable the pilot to determine targets and geographical features. The screen's automatically processed the desired approach, disburges its weapons and leaves the target area. The pilot may easily alter course if the situation demands it.

This is just one of several important projects at Norden involving advanced television and radar systems. It is another Norden contribution in strengthening our nation's defense by Electronic Man's CAPABILITY.

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HYBRID TELEMETRY SYSTEM for efficient and accurate applications being developed by Aerospace Division of Ford Motor Co. under revenue program can transmit many data by pulse amplitude modulation (PAM), digital data by pulse code modulation (PCM) or data of widely different amplitudes in minimum by a sum of all two techniques, called PACM. This video frequency carrier is frequency modulated in each case. Block diagram of receiver PACM telemetry (left) differs from PCM/FM system by addition of decoder by pulse width which codes PAM data directly to the modulation. Single ground station (right) can accommodate FACM/FM, PCM/FM or PACM/FM.

Services to Investigate Hybrid Telemetry

By Barry Miller

Newport Beach, Calif.—Aerial sensors are planning to test a hybrid telemetry which combines as a single system the capabilities for high accuracy and high data rates inherent in pulse code modulation (PCM) and pulse amplitude modulation (PAM) systems respectively.

Known as PACM/FM (AW Apr. 4, 1968, p. 115), the hybrid system is so designed that analog and digital signals in the form of PAM or PCM can be interlaced on the same frequency-modulated RF carrier. If received, as common in data transmission (DPM), or lost as desired the system can be made to acquire predominantly or entirely with PCM if medium accuracy is acceptable. The system can use PAM with its advantage of high data rates.

The first PACM/FM telemetry system currently is being built here by engineers of the Aerospace Division of Ford Motor Co. This organization was a recent industry competitor, sponsored by the Air Force's Aeronautical Systems Division (James Wright Air Development Division) to build and demonstrate a PACM/FM ground system and simple airborne PACM equipment.

Aeronautics' contract, valued at roughly \$550,000, is a combination of a television investigation of hybrid ground and mobile telemetry needs and the PACM/FM concept is an outgrowth of a previous contract from the Army's Signal Corps as part of the Intruder studies (AW Apr. 4, 1968, p. 115).

After a survey of telemetry needs and a projection of expected telemetry requirements, Aeronautics engineers conclude that the PACM/FM system

will satisfy 90% of instrumentation requirements for the next 10 years. It has the advantage, of facilities, provided by the dual modulation scheme which makes it possible to study a wide range of future telemetry needs.

An example of its use, if PACM/FM was employed as a laser probe vehicle, the program now it would operate in different modes depending on its flight profile. During launch and until apogee into orbit, all vibration and instrumentation data, as well as a suitable video channel output, could be transmitted in PACM/FM. When the vehicle is in earth orbit, and vibration data is no longer required to certify that the properties of PAM to PCM modulation could be examined. At lunar distances the modulation ratio can be changed to raise the proportion of PCM for slow-speed, high-accuracy data transmission.

Tests of the system will be conducted at a national test range, still to be selected, sometime after the equipment is delivered to the Air Force next year.

An important aspect of Aeronautics' Air Force contract will be to develop general performance specifications for the PACM/FM gear which eventually could become a military and industrial standard for general purpose use. These specifications would govern modulation of time division multiplexing a channel to compare for PACM/FM hardware defined by radiation, industrial or space agencies, Aeronautics grants aid.

Aeronautics, apparently confident that the aerial service will proceed with the development of a system based on its recommendations is in order. Signal Corps contract, began developing a PACM/FM model over a year



HYBRID telemetry (PACM/FM) ground station and simulation of airborne component (see two pages left). On item of television-supported survey of telemetry needs requirements (AW Apr. 4, 1968, p. 115). Aeronautics engineers say that PACM/FM could satisfy 90% of telemetry requirements for next 10 years.

Recording and measuring the performance of a radar surveillance and tracking system is just one application of Flight Research photographic instruments.

Flight Research automatic, multiple purpose cameras and control systems are also now in use measuring phenomena from the courting behavior of birds to booster separations, from underwater weapon performance to flights toward the sun.

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ago. It now will allow with the ground station and a monitor of the airborne portion of the equipment.

Besides its flexibility, other desirable features of the hybrid system, according to company engineers, are:

- **Minimum susceptibility to interference**
- **Optimum use of RF spectrum**
- **Maximum transmitter power and equipment weight**
- **Specifications for the Annamouth hybrid telescopes include:**
 - **Modulation technique**—PAM, PCM or combination of the two introduced on a single carrier
 - **Bit rate**—Selectable from 5,000 to 500,000 bps/sec. in accordance with IBUG (Inter-Range Instrumentation Group) telemetry standards
 - **Accuracy**—Capable of achieving 0.01% only capability of overall system type of 0.1%
 - **Bandwidth**—While a frequency of reference bit rate, the maximum receiver RF bandwidth is 1 mc at 500,000 bps/sec.
 - **Word and frame structure**—Frame lengths of 2,048 bits and PCM words from 6 to 64 bits are provided
 - **Frame synchronization**—Predefined frame synchronization words up to 33 bits long are available
 - **Word structure**—In PAM mode, 50 and 100% duty cycle sample pulses in PCM mode, NRZ (nonreturn-to-zero) pulse format, in the PCM mode, 100% duty cycle, PAM pulse length as defined multiple bit rate. PCM bit period while PCM encoded analog data words are 6.17 bits with bit bit parity and digital data words are 6 to 64 bits

In block diagram form (shown in diagram on p. 74), the airborne portion of the PCM/FM system differs from a PCM/FM system by the addition of an encoder before which which carries PAM data directly to the transmitter modulator. In addition, the programmer which is the heart of the airborne equipment is more complex.

The encoder before which carries PAM data directly to the transmitter modulator which is the heart of the airborne equipment is more complex.

The encoder before which carries PAM data directly to the transmitter modulator which is the heart of the airborne equipment is more complex.

All of the timing and logical operations governing the final pulse stream format are controlled by the programmer. The three basic generator controls the programmer's rate of operation. Among the signals generated by the programmer are stoppage pulses for

the multiplexers and submultiplexers, sample command pulses for the sample and hold circuit, PAM and PCM select pulses for the encoder before which, reset and parity interrupt pulses and word "error" and "true" for the decoder.

An 11-stage binary counter gives the programmer capability of generating timing signals at any bit position within a frame according to a report on the system prepared by Annamouth. It is available at any desired count within 2,048, representing the total number of bits per frame employed in a application and is accomplished by a player count counter output.

The system's dual ground station can convert, demodulate, record and display PAM/FM, PCM/FM and PAM/FM at all of the standard bit rates selected by switch and plug in.

Increasing RF signals are passed through an RF bandpass filter to protect the multiple components, superheterodyne front end and frame avoid due to strong adjacent channel interference.

The programmer in the ground station performs encoding and logical operations needed to separate PAM and PCM words within the frame, time the detectors, the demodulator and word parity check.

Several years ago, when the recent dose Annamouth to conduct a study of telemetry needs over the next decade or more, one reason for selecting this company was that it was not a "telemetry company" as such. Annamouth, however, did not have a previous commitment to one form or another of telemetry system. Now, however, Annamouth is confident this should the system decide to go ahead with PAM/FM performance it will be one of the companies competing for the business.



Moonlight Detector

Moonlight detector for determining orientation of a satellite relative to the sun, has sensitivity 10 times that of a conventional photo cell unit, according to International Business Machines Corp. which developed device for NASA. Commercial semiconductor photodiode is replaced by silicon crystal covered with a transparent dielectric (antireflective) coat. Loss of light energy by absorption is greatly reduced because light penetrates liquid mass easily than semiconductor material.



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★ **Guard Ring Impacts Nuclear Detectors**—Encircling a shallow guard ring from a semiconductor particle detector appears to improve the signal-to-noise ratio and stability of detectors, scientists at Sandia State Laboratories, Inc. have found. The guard ring, five microns in depth and 2 microns in width, etched through the passivation plus a single external electrical connection, tends to decrease surface current—the source of noise in the detector. Detectors made with the guard ring

★ **Guard Ring Improves Nuclear Detectors**—Encircling a shallow guard ring from a semiconductor partially detaches an upper and stabilizes a detector, sometimes at Solid State Radiation, Inc. have found. The guard ring free response in depth and 2 currents in width studied through the junction plus a single external electrical connection tends to decrease surface current—the source of noise in the detector. Detectors made with the guard ring

***Solar Cell Testing Speers Non-Fin-** financial specifications for a solar simulator which would reproduce the spectral characteristics of the sun are being forwarded only this first time by the American Institute of Electrical Engineers Subcommittee (AWO Dec 17 p 45) representing solar cell manufacturers and solar cell users. The specifications describe an artificial light source which could be used through out the industry for testing and measuring solar cell efficiencies. Lack of an-

► **Franchise Life Test Shows Climb:** Philco says that during the past five years it has succeeded a total of more than 500 million in of operations in insurance life tests. As present the company is accumulating life test data at the rate of 2 million per year and with new automated test equipment it expects to accumulate a total of more than 24 billion in of test time by 1985. Philco says its franchisees presently are providing a reliability of only one failure in 50 million hr.

Vital Military Electronics Research Areas Proposed—Many important areas of research in electronics have been proposed in a recent survey of leading scientists and engineers by the Office of Director of Defense Research and Engineering. Of 200 separate sub-areas, 22 sub-areas submitted by 49 percent, 82, or roughly 70% of all respondents, are listed on more or less a par with the following: "solid-state and integrated circuits; solid-state and integrated sub-systems (adaptive computing, self-learning devices, etc.); sub-systems, communications and command and control; reliability, computer and data processing; energy, emission and storage; optical sensors and sub-systems; wave devices; materials research and development; and research and development in repair and maintenance." The report is published in the "Research Areas of Electronic Research."

* **Venus Radiation at 4.3 mm.** Reported—Naval Research Laboratory scientists have measured energy radiated from the planet Venus at a wavelength of 4.3 mm, believed to be the first time that such energy has been measured. New data is expected to aid in determining the temperature of the planet which has been estimated at between 280° and 600°, based on measurements at other wavelengths.

* Winter Study Group Report Available—An abstract of the Air Force Winter Study Group Report, analyzing current and planned IIRAF* concerned and control systems, is available to companies having an established "need to know" and access to "Confidential" material. Such companies may request copies from Deputy for Advanced Planning, Electronic Systems Division, Hanscom Field, Bedford, Mass.

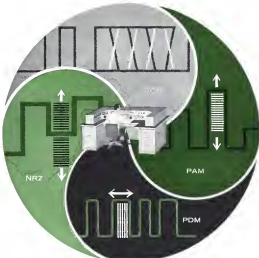
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SPACE TECHNOLOGY



SPACE STATION STUDIES involving the design of orbiting laboratories include concepts of a inflatable design (left). Vehicle studies would be studied for launch and arrival after insertion into orbit. Another concept includes Goddard Aircraft Corp.'s model of an inflatable bus for taking, deployment and verification studies (right).

NASA Explores Space Station Problems

By Edward H. Kolman

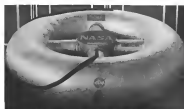
Langley Field, Va.—Basic research conducted here on the design problems of manned orbital stations is expected to contribute valuable environmental data to National Aeronautics and Space Administration's planned long-term landing program.

Langley Research Center space station office has undertaken a series of projects aimed at studying and solving basic problems involved in designing long-lived orbiting laboratories serving as an astronaut's home. Although research centers around models of crewed structures, actual configurations and mission planning are not primary goals of the broad program.

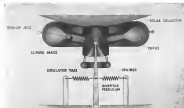
Joseph A. Shortt, chief of the Applied Mechanics and Physics Division, which includes the space station office, says a need for manned orbiting laboratories beyond the background information they can provide for the Apollo program (AW Jan. 15, p. 38). He looks on the orbiting laboratory as an extension of ground facilities for a broad range of engineering and systems studies.

Edward Schnitzer, who heads the space station office, told Avionics Week that his group is concentrating on structural behavior, dynamics, stability and variable gravity, gravity supply, life support and materials requirements for stations with maximum operating lifetimes of a year.

Such structures, he said, would provide facilities to study the ability of an organism to adapt to long periods of reduced gravity, radiation, and life



TEN-FOOT DYNAMIC TEST MODEL of NASA's manned space station. Elastic "bones" will move over the tank to determine the effect of weight on stability (above). Dynamic test rig (below) is being installed at Langley Research Center to test a 10-ft scale model of a manned orbiting laboratory. The facility will be used to learn responses, shaking inputs, stabilizations. Guzman is building a 34-in. model for thermal chamber tests.



ENGINEERING PRECISION GUIDANCE

Inertial guidance activities at General Electric's Ordnance Department represent some of the most exciting and challenging work areas for engineers with creative abilities. In addition, the Polaris MK 2 Guidance System demands that the Navy's leadership requirements for the kind of precision that Ordnance Department engineers and scientists can deliver.

Here is an area that offers personal responsibility as well as professional challenge. A formal performance review is made annually for each professional employee and top executives reap the benefits of a high promotional rate. These positions, together with expanding program activities, have resulted in a number of openings for qualified engineers and scientists. We would welcome the opportunity to provide details.

Fastest and unexpected growth continues to expand opportunities in these areas:

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- Guidance and Navigation Engineering
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FOR MORE INFORMATION write in confidence to:

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Professional Relations, Box 64-100
Ordnance Department
General Electric Company
Pittsfield, Massachusetts

All qualified applicants will be considered for employment without regard to race, creed, color, or national origin.

GENERAL ELECTRIC

in an artificial environment. The situation also could be used to fight test stabilization and auxiliary power systems, structures and materials, communications, orbit control, rendezvous and navigation.

Demonstration model of one Langley space station is a segmented torso with its own solar collector power unit. The collector is folded like an umbrella, with the torso wrapped around it for packing in a nose cone for launch. The crew would be housed in a life support module beneath the collector torso pack.

Most escape systems in this launch configuration would be out the side.

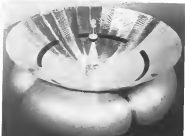
Langley has completed construction of a 70-ft diameter torso to be used in dynamic studies, which will simulate effects on a full scale station with a 10-ft diameter. The station has designed a dynamic test rig with five degrees of freedom which will permit movement of docking impacts and stabilization. Shifting loads will be simulated with an "electric mosaic," which will travel over a track.

NASA is conducting a second test chamber with a simulated sun source, orbital loops and the ability to reach thermal balance at a pressure of 10^{-4} mm of mercury.

Crossman Aircraft Corp. is building



SEQUENCE, left, above and below, shows inflatable portions for a manned space station model used at Langley Research Center. Solar collector is folded like an umbrella and the station is wrapped around the collector during launch. Components are released for operations upon microcosmosis pressure activity.



PRECISION GUIDANCE



POLARIS "ON COURSE"—TIME AFTER TIME AFTER TIME

Over 40 Polaris missiles—with completely operating inertial guidance systems designed by Massachusetts Institute of Technology and produced by General Electric—have been flight tested from 1955, on the sea, and under the sea.

The especially precise, reliable performance of this MK 1 Inertial Guidance system now is being applied to the advanced MK 2 Polaris Inertial Guidance system by IRT, G.E. and Raytheon.

This new, advanced guidance system will be much lighter and more accurate, and will help lengthen the striking power of Polaris from 1200 to 2500 miles.

Polaris Inertial Guidance is typical of the many precision products—torpedoes, fire control, inertial guidance, launching and handling equipment, torpedoes—being produced by General Electric's Ordnance Department.

18-0

ORDNANCE DEPARTMENT

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Systems with flexibility of interchangeable preamps—50 mm channels, 4 speeds; available in 35" high metal cart, in carrying case, or for rack mounting.

With highly developed, versatile preamps: Model 200 sensitizes from 10 to 100 mV of volts, unbalanced electronic; variable "500" preamps include Carrier, DC Coupling, Differential DC, Phase-Sensitive Demodulator, Logarithmic, Frequency Division and Low Level types; Low Level preamp available with plug-in for general purpose DC with or without auto suppression; and for DC virus prep work, system occupies 14" in rack.

With simplified, miniature preamp Model 201 sensitivities from 10 to 100 mV of volts; transformerless electronic; "500" preamps include Phase-Sensitive Demodulator, DC Coupling, Carrier, Low Level types; plus MOSFET for chopper and carrier available; system occupies 16 1/2" in rack.

New Model 202 DC Coupling, 10 sensitivities 10 mV to 50 mV/rms, calibrated zero suppression; ± 2.5 or ± 5 max (Model 202A without auto suppression); push-pull input, 5 megohms to ground each side.

New Model 201 Carrier for AC transducer work; maximum sensitivity 10 mV rms/rms; modulation 5 mV/rms; impedance 100 ohms; auto-suppression; auto-suppression.

Model 200 General Purpose DC (balanced); 12 sensitivities 0.5 to 50 mV/rms and ± 10 mV; input impedance 10 megohms (100 mV/rms range) and 1 megohm (50 mV/rms range); floating and guarded outputs.

All models occupy approx. 1 cubic foot, can be placed horizontally, vertically, or sitting on handle at 60° angle, all except optional paper take-up (shown).



SANBORN COMPANY
INDUSTRIAL DIVISION 133 Wyman St., Waltham 24, Massachusetts

a 14-in. model of the station for thermal shakedown tests.

Schneider and one of the group's major studios concerns gravity of bits, which would be induced by the crew by activating spin rockets. Tests under way at the Langley outdoor centrifuge indicate a 40-ft diameter turn would have a uniform 6.1-g force. It was intended to spin Langley's effects of the aerodynamic environment in one of the basic unknowns is extended space flight, and Schneider said the force is the ideal configuration of gravity to be induced.

A cylindrical shape appears best with one gravity, but any shift in external weight produces large amplitude wobbles, he said.

The division test program includes movement of a whole cluster, in three-way rigid body wobbles to see of an air bearing flowfield with g's.

Goodwin Aircraft Corp. is building a 24-ft expendable turn under a NASA contract which the agency will use for variable gravity studies and to determine the best methods of taking deployment, motion, vibration and maintaining in 5-pass atmosphere.

Goodwin built a medium-size spin station can be braked to 1 ft, using to enable structure which could be washed by spraying quick-setting plastic between the vertical walls.

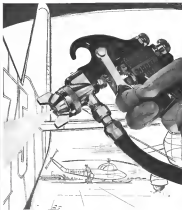
Schneider's group is looking at a variety of tubes and electronics in materials records and recently awarded a study contract to American Machine and Foundry Co. for a closed cycle water recovery system in the life support phase of the program. The agency also is studying removal of carbon dioxide from the station with a molecular sieve. Among materials under study both in NASA and industry are three-ply dyes, heat-treated dyes, ultraviolet absorbers and ultraviolet sensors.

Although configurations and measures are considered to protect of the group's station, some unique concepts have been developed during the studies. One is a single-atom station based on the Mersin capsule, surrounded by an inflatable Gossamer tube. The center station would weigh 500 lb and could be launched into a 100-m-circumference orbit with Saturn C-1.

The group feels that such a station could provide critical data on air canal systems in a weightless environment and prove theories of passive heat and refrigeration.

Another unusual concept is the use of inflatable balloons, which would be moved and made rigid along with the base structure. Churn, bumps and shocks would be free of tubes and folded for launch.

The group also is studying a inflatable extrude configuration, with alternate 20-ft metal and fabric cylinders.



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This Universal Tester is the latest Bendix achievement in the Support Equipment field and is another example of the engineering and production skills we have developed over a period of forty years. Whether the need is military or commercial, Bendix can provide the answer that does the job best.

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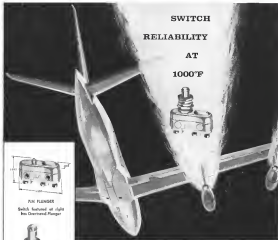
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Astra Designs Lunar Atmosphere Simulator

A 300-lb diameter lunar atmosphere simulator, big enough to house work, big parties and heavy equipment in rugged planetary or lunar terrain, has been designed by Astra Inc. and Sverdrup, Inc., of Raleigh, N. C.

Rapid structural response, a pair of gaseous thrust spheres, shell construction in the center like a vacuuming pool and the other enclosing the surface with a dense, pump liquid, air locks for men and equipment and emergency exits as entrances would be spread around the periphery.

Lunar atmosphere gases could be dropped to less than 1 psi, and the atmosphere of plasma could be simulated.

It could not be possible to obtain the hard vacuum desirability of the moon because of structural limitations.

Interior of the double-shell structure is divided into zones, each with a typical terrain feature: water, forest, snow, mountains, and plain. Punched in the 140-ft-high ceiling, contains radiant heat sources, which can be lowered to focus heat on a sector. Refrigerant coils buried in the soil would keep the temperature to simulated surface values approximating a dark-side environment.

Flare to Simulate Flash of Zeus Warhead

Astra has made 71 successful firings of a high-power magnesium spotting device, viable to 40 mi., for use in the forthcoming Nike Zeus tests at Kwajalein Island against ICBMs. The flash charge, designed and developed in several configurations by Bell Telephone Laboratories, Whippany, N. J., will be triggered at altitude to simulate explosion of the Zeus warhead. It will serve as a zero-distance indicator as well as visual confirmation of corrected signal reception by the warhead.

Turbogenerator Powered By Solid Propellant

Turbogenerator for on-shaft metallic applications will be developed by General Corp.'s Milwaukee Wg. Co. under contract from Army Ordnance's Ordnance Agency, Dover, N. J.

The turbogenerator will be powered by a solid propellant and will supply 150 watts for 100 sec., for delivery in a 2- and 4-c output.

User will weigh these pounds and will be enclosed in a 23-in.-dia. package comprising gas generator, turbine, electrical generator, controls, regulators and rectifiers.

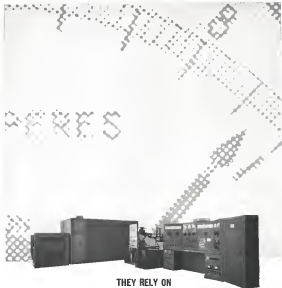


A New Refrigeration Compressor For Weapon Support Systems

The first for hermetic compressor design, specifically for gaseous and liquid applications, this lightweight, solid piston unit operates in the low industrial speed zone of 3,400-3,700 RPM, ensuring exceptional reliability and long life. Unique design permits thermal isolation of unit. An internal centrifugal expander reduces refrigerant subcooled oil to the compressor pump eliminating need for an external oil separator while increasing heat exchanger efficiency. Compressors are also available in 24-ton capacities. Plead for well above 10 actual size.

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Radiation at Standard (formerly Keraohall) designs and builds high-power radar and communications transmitters, modulators and power supplies. The 50 megawatt modulator for radar and component testing is typical. It also contains a unique capability for solving the special problems of superpower RF.

Two major design considerations in superpower RF equipment are performance and safety. In this unit—as in other Radiation-built systems with peak power to 100 megawatts and frequencies to 90,000 megacycles—special circuitry operates at microsecond speeds to prevent damage to the equipment. It includes five sub-assemblies with remote controls connecting all controls, interlock indicators and measuring readouts.



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Visitors to the 1960 International Air Show in Paris, France, gather for an opportunity to view the Project Mercury space capsule displayed alongside the U.S. Space Shuttle exhibit. Space capsule carried Col. Alan B. Shepard, Jr., American astronaut, to a novel height of 117 mi. on May 5. Mercury ballistic flight was boosted by an Atlas 40,000 lb. Redstone vehicle.

French Throng to See Mercury Capsule at Show



Project Mercury space capsule (left) is scheduled from a USAF C-119 at Le Bourget field, Paris, for delivery to the USAF space exhibit at the air show. USAF Col. E. O. Gress, Montgomery, Ala., commander U.S. Military Participation 1960 International Air Show (right) explains the mechanics of the space capsule to visitors. Capsule proved to be a big attraction at the show.

"As a tactical strike aircraft in support of ground troops, it can deliver its warheads, a stream of 6000 rounds per minute and a bomb bay packing a heavier load, either conventional or nuclear than a typical B-57 bomber." — *Time*

"The plane has the versatility to perform attack as an all-weather fighter or high speed reconnaissance plane." — *New York Times*

"The F-105 bombers are the sole combat flexibility and clear weapon capability." — *Flying*

"In effect, a reusable guided missile." — *Aviation Week*

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Inadequate Ion Systems Funding Scored

Los Angeles—United States' projected funding of ion propulsion systems must at least be doubled and perhaps tripled, if the House plan in this field is to be improved, the report said, coming of the Institute of Aerospace Sciences and American Rocket Society was told by an electrical propulsion specialist.

Test findings of the National Aeronautics and Space Administration's Marshall Space Flight Center, said a minimum three-pronged effort is needed to provide:

- Accelerated development of a higher power ion engine than the present suboptimal 10 kw. Step 1 generator, so that sufficiently large power supplies would be available to mate with ion engines in the near future. A 5 to 1 kw supply, under 10 lb./hr., would be adequate for an ion propulsion system to carry payloads to any planet in the solar system.
- Accelerated development of a 60 kw

engine which would serve as a starting program.

- Continued aggressive research and development programs and a specific application research in construction of a 10 kw ion jet engine.

Stahlberg said that such an effort would necessitate an additional \$6.5 million and use the total fixed 1962 funding for electrical propulsion to about \$11 or \$12 million. For fixed 1963, the program would then rise to between \$25 and \$35 million and \$50 to \$60 million a year in the fiscal 1964 to 1966 years. Stahlberg was quoted in his remarks by Capt. Richard J. Thies, a USAF officer on loan to NASA to coordinate ion propulsion programs.

Current funds for ion engines provided out, do not permit any large-scale supporting work—no distinct from engine development paper-and-pencil study adequate to permit flight of the Hughes Aircraft Co. ion engine in a

Scout vehicle as planned for October, 1962.

In other IAS/ARS sessions, S. C. Mironov of Space Technology Laboratories, made the introduction suggesting that "brute force" methods may be a way of achieving reliability in space programs.

High Cost Cited

As an example he suggested that a salvo of standardized space probes might be desirable if launch opportunities such as the relative positions of Venus and Earth—recurring infrequently—Mars occur. The high cost of a "brute force" approach led and that they might be justified in the case of one shot missions and that the firing of two probes each with a probability of 0.9, would increase the chance of at least one success to 0.99, if both were truly independent.

Further, he suggested an increase in



Mars Flyby Satellite Could Drop Instrument Capsule

Recently-conceived design study by the Jet Propulsion Laboratory of a Mars flyby spacecraft envisions a 900-lb. instrumented capsule which would be fired along a steep velocity angle to the planet from a distance of about 120,000 km. Trajectory and point-of-impact would be so selected that planet's rotation would orient the capsule's instruments between capsule and earth. Freewheeling capsule would transmit data back to the spacecraft, which—coming within 4,000 km. of Mars before jettisoning its deep-space—would then enter the atmosphere back to earth. Total flyby time for data after is estimated at 15 hr. Instruments, loaded in inert with antennas and housekeeping instruments folded for launch, would weigh 1,440 lb. and could be lifted by an Atlas-Centaur.

design margins and greater densification of components to improve reliability. The attendant extreme redundancy and redundancy weight, he felt, would be paid for by the weight increased.

Also reported at the meeting were:

- **Radiation-resistant** jet engine, developed by R. K. John, *Avco Aircraft and Aircraft Development Division*, Woburn, Mass. The engine, employing either ammonia or hydrogen as a working fluid, has operating conditions such as up to 100 hr and chemically inert for a closed-cycle cooling loop. John said that a specific example of 1,000 sec is possible with the engine using ammonia.

- **High-efficiency** engine on engine, built by *Electro-Optical Systems, Inc.*, has produced up to three independent of thrust and has operated continuously in a stream chamber for 375 hr. The 60-horse engine described by M. F. Brinkley of the company, says produce specific impulses of 5,000 to 6,000 sec and efficiencies up to 65%. Company hopes to reduce current power to three times of 250 hp/70.

- **Low engine**, employing power, heat, and thermoelectric sources, was presented by Ronald J. Chalkin at NASA's Lewis Research Center. Sample optimum data were specific impulse, 11,000 sec; maximum power

1 hp; current density, 85 amp/cm²; acceleration and power efficiency of 97.5 and 41.9% respectively. In another test, engine were 12,000 sec, 13 hp, 36.5 amp/cm², 92 and 35.5%.

- **Plasma jet**, described by Paul S. Minic, *Plasmajet Corp.*, a jet with burner design equalled at an oxidized theoretical flame flow efficiency and a specific impulse of 1,000 sec can be achieved using hydrogen as the burner.

PRODUCTION BRIEFING

Barton Mfg. Co., Santa Monica, Calif., will build calibration equipment for automatic systems for the Air Force under \$250,000 contract. The portable unit permits on-line calibration of flight instruments, air data sensors and flight recorder.

Sandus Associates has a \$2146,980 Navy contract for anti-submarine warfare aircraft.

Boyd & Whitney has a \$50.6-million Navy contract for continued production of J87 turbo turbojets, with 521.4 million of the contract for Air Force engines.

Atlantic Research Corp. has a \$340,000 contract from Air Force Flight Test Center for solid propellant research.

General Electric Co.'s Flight Propulsion Division has received subcontract from Thrujet Corp. for manufacture of first-stage *Marquardt* solid-propellant engine. Contract for value approximating \$9 million will run through 1982.

Model Engineering and Mfg. Corp., Hawthorne, Ind., will supply guidance and electronic components for the *Ballistic* anti-aircraft missile and the *Spartan* anti-air missile. The company will provide 200 spring guns for Ballistic propellant system produced by the *Missile Electronics Corp.* (AW June 10 p. 11). *Microelectronic* components will be supplied for the *Spartan*, which guidance system control from *Raytheon*. *Spartan* spring motor.

Bendix Corp.'s Scribner Division, Sidney, N. Y., will produce solid-state electronic components for the *Palladium* missile launch tubes under \$900,000 contract from *General Dynamics Electric Boat Division*. The electrical components will be the control center of the submarine and the missile in the launch tubes.

Garrett Corp.'s A-Research Manufacturing Division, Phoenix, Ariz., will build engine stations for the *North American Hornet* Dog anti-aircraft

missile under \$1.7 million contract. Both dual solid propellant-motor and motor and pneumatic probe stations are included in the contract.

Harold-Stratford Division of United Aircraft Corp., Windsor Locks, Conn., will continue production of *Beech* B-57H *Thunderbolt* aircraft engine equipment under \$600,000 contract. The number from Boeing is for the plane's engine air conditioning packs.

Bowditch Corp., San Antonio, Tex., has received a \$679,000 contract from the Navy Bureau of Ships to develop a shipboard communications terminal for the *Advanced Communications Satellite* program.

Avco has awarded *General Electric* a \$1.1 million contract for the *Advanced Communications Satellite* program. It will produce solid-state electronic components for the *Advanced Communications Satellite* program.

Thiokol Chemical Corp. and a French company, *Société de Produits de la Propulsion* par Reactions, have entered into a reciprocal sales arrangement for the marketing of solid propellant rockets in the U. S. and France.

University of Michigan has been awarded a \$270,000 contract from Na-



Adm. Raborn Is Awarded Collier Trophy

Vice Adm. William Raborn, Navy director of special projects, spent hours in the Chief Executive's office, advising the Robert J. Collier trophy with President John F. Kennedy. President Kennedy awarded the trophy to Adm. Raborn for his direction in the development of the Polaris missile weapon system (AW May 22, p. 18).

National Aeronautics and Space Administration for high-speed satellite communications, to be made by hollow fiber antennas.

Messner Mfg. Co., Burbank, Calif., will supply *Dauphin Aircraft Co.* with titanium alloy pressure vessels for the *NASA Saturn S-IV* rocket. These vessels already have been constructed by Dauphin at its Sacramento facility, as the *Minuteman* vessel undergoing in liquid testing at -42°F.

Wilcoxon Castle Co., Rochester, N. Y., will study various methods of studying equipment aboard deep space probes under the terms of a \$106,600 *National Aeronautics and Space Administration* contract.

Dynastar, Inc.'s Pacific Division has received a \$108,000 contract to develop a flight control assembly, electronic components, for the *USAF GAM-77* (Hound Dog) anti-aircraft missile from *Valencia* Div. of *North American Aviation*.



THE CANADIAN DEPARTMENT OF DEFENCE PRODUCTION HAS ANNOUNCED PLACEMENT OF A PROCUREMENT ORDER FOR TWENTY FOUR PERFORMANCE PROVEN LIGHT OBSERVATION HELICOPTERS. THE SAME ROTORCRAFT HAS BEEN THE CHOICE FOR GOVERNMENTAL AND COMMERCIAL USE IN MEXICO, COLOMBIA, ETHIOPIA, CHILE, AUSTRALIA, PUERTO RICO, ECUADOR, MOROCCO, ARGENTINA, RHODESIA, INDIA. THE HELICOPTER—THE MOST POWERFUL IN ITS CLASS—IS THE 12 SE MANUFACTURER

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Problem for Skybolt: Where is this patch of sky?

To calculate its trajectory to target, Skybolt air-launched ballistic missile will have to know precisely where it is at any given moment, day or night. This problem is easily solved by the star tracking capability of its Astrocentral guidance system, which can provide an instantaneous fix on any piece of sky the missile plans to pass through. When Skybolt is operational, the guidance system will put it into a ballistic trajectory after launch, to deliver the warhead on target up to 1000 miles away.

This versatile star-monitored inertial guidance system is being designed and built by Nortronics for the USAF Douglas Skybolt, now under development.

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Control Console . . . for high accuracy measurement of the characteristics of radomes of ultra-precision class . . . this unit can measure test operations either manually or automatically



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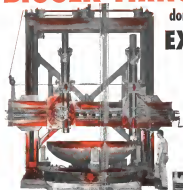


Radome Holding Fixture . . . designed by Dunn to be moved entirely in the x-y plane of the dish, maintaining fixture coupling, isolation, and back-sightings



Master Microwave Source . . . provides pulsed microwave signals simultaneously at three different frequencies to a maximum of three radome test stations. Unit may be switched on and tested locally for test and adjustment.

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Blue Water Displays Launch Mobility

Fairchild's Blue Water Army for most missile organizations the maximum checkout system and requires no on-trail dunnage, making it possible to launch the unit by means of a simple cable-connected firing switch.

In the firing sequence after the launcher transporter has been moved into position the switch is tripped out to a distance of approximately 50 yards, with the launcher launchers consisting to a point slightly above a straight line with the Blue Water to avoid firing coils and other debris that stream out at a 90-deg angle at blast off.

One half of the switch, in the form of a command or sensor no-circuit sensor, is mounted on the launcher transporter to the missile that initiates its internal power supply package. At the same time the trigger begins to raise the missile in launch position and the final checkout automatically begins, with a series of red and green lights on the base box of the firing switch linking on and off to keep the operator informed of its progress.

Close to firing position, and with all lights on green, the missile is launched by a manual activation of the switch. English Electric, developer of the sub-perforated Blue Water system, originally considered a unit in which one operation of the switch would be sufficient to raise the launcher through the checkout phase and fire through actual launch. The idea was abandoned, however, because of the complexity of the system that would have been required and because of the danger that an instant impulse might result in a launch before the carefully planned Blue

Water was in its full firing position. Made from the regular scheduled research and development launches Blue Water has been fired more than 24 times in specific tests of the durability of the launcher transporter unit. The same launcher transporter has been used in all firings.

Since point has been shown even by wind blast in the air launch area and the order of the tests has been dictated somewhat by the blast effect and firing delay from the ground. Orders were according to an signal connected with the project the launcher transporter in a good condition and fully operational.

Blue Water, which the British would like to sell to North Atlantic Treaty Organization members as a replacement for the obsolescing H-11 wing, Cor

good, was put on public display for the first time at the 74th Army International Air Show at Ft. Benning, Georgia. While its range has not been officially disclosed, it is believed to be comparable to the 55 and 60 of the U.S. Sergeant.

British spokesman say the Blue Water can be fired within 10 min after it has been fired from its camouflage building position to a previously selected launch site. Only charges required at the site are the launcher transporter mounted on a standard three-ton chassis and a long wheelbase Load Rover carrying a ground computer that feeds final target data into the missile guidance unit immediately prior to the launch countdown.

After firing, the spokesman say, the launcher transporter can be on its way again within five minutes.



SWITCH in long-range vehicles carries the periphery of Blue Water missile



NAVY-SIKORSKY HSS-2 SPEEDS TO NEW WORLD RECORD

Last month, U.S. Navy pilots in a Sikorsky HSS-2 crossed the finish marker on a three-kilometer straight line course to set a new world helicopter speed record. The speed: 192.9 miles an hour—58.8 miles an hour faster than the previous record set by a Russian Mi-6 over a 100 kilometer closed course in 1969. This was the first official speed test of the new

generation of Sikorsky twin-turbine helicopters. The first-built HSS-2, which flies in its standard configuration, soon goes into fleet service as a key weapon in the nation's anti-submarine warfare defense. It is the world's most advanced helicopter weapons system and now the world's fastest helicopter as well. In a few months its commercial version, the

58-passenger S-61L, will enter service with Los Angeles Airways and Chicago Helicopter Airways. The record-breaking performance by the Navy-Sikorsky HSS-2 provides an anticipated highlight for the 50th anniversary of Naval Aviation being celebrated this year.

Sikorsky Aircraft

Division of UNITED AIRCRAFT CORPORATION, Stratford, Connecticut

RF-01 Specifications

(Production Version)

Dimensions:	
Span	36.75 ft.
Length	19.91 ft.
Height	5.99 ft.
Aspect ratio	11
Wing area	218.95 sq. ft.
Wing thickness/chord ratio	35
Weights:	
Empty weight	155 lb.
Useful load	46.5 lb.
Gross weight	728 lb.
Wing loading	9.746.7 psf.
Load factor	10

Performance:

Cruising speed	188.9-212.8 mph (2.4 gals.)
Maximum speed	51.8 mph (1.6 gal.)
Rate of climb	688 fpm
Rate of descent at 45° angle	4.27 fpm
Rate of descent: flap down	15.45 fpm
Landing speed	40 mph
Takoff distance	125 ft.
Service ceiling	19,650 ft.
Range	660 plus mi.

Powerplant:

One 11 hp Goetz Volkswagen engine

the wing, neither wings of the RF-01 are made of laminated wood and covered with fabric.

The landing gear consists of a single retractable main wheel located under the forward fuselage section and two fixed struts attached to the center section of each wing. A wheel tail wheel controlled by the rudder bar carbide differential control is maintained when taking.

The landing gear weighs only 29 lb., but is effective even in a strong crosswind according to Locant.

Fuel Consumption

Low power flight of the RF-01 gas turbine is economical. With reduced throttle, speeds can safely be maintained at 55.8 mph, with a fuel consumption rate of less than 5.2 gph.

For cross-country training, the aircraft cruises at approximately 91.1 mph at normal power output of one more than 24 hp. Fuel consumption at this speed is about 1.7 gph.

Low wing loading, a wing thickness/chord ratio of 17 (production model will be 18) and a rate of descent of less than .494 ft. also make the compact RF-01 suitable for training in flying.

The relatively large wing span does not inhibit the aircraft's maneuverability, and its 21 hp powerplant provides sufficient power reserve for both cross-country, which also can be performed when the engine is not out.

PROBLEMATIC RECREATIONS 72



A spider and a fly are located at opposite vertices of a room of dimensions 1, 2 and 3 units. Assuming that the fly is too terrified to move, find the minimum distance the spider must crawl to reach the fly.

—Contributed
The new technical handbook coming up from our USESCO Division adds a nucleus of additional reliability to transformers, electronic capacitors, plug-in type modules, tube sockets, core type delay lines, and flow networks. They're loaded from an improved low-loss material filled phenolic. High insulation quality. Don't want the tape to write for further information: U.S. Engineering Co., 11536 Salsbury St., Van Nuys, California.

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Oriented in the public interest and dedicated to providing objective leadership in the advancement and application of space science and technology for the United States Government



AEROSPACE CORPORATION

Italy's Santa Maria Makes First Flight

First production model of Aeromach Lockheed's Santa Maria light aircraft made its first flight recently at the company's airport in Virago, Italy. Plans developed by Lockheed's Europa Division and manufactured by Aeromach in Italy, it is being marketed as a light transport. The first Italian production model is undergoing certification tests by the Registro Aeronautico Italiano. U.S.-built prototypes clearly have been certified by the Federal Aviation Agency. Plans to market the Lockheed Aerostar L440-50 being made in Italy under similar arrangements in Mexico (AVW Apr. 15 p. 314).



Near-Miss Reporting Program Established

Washington-Federal Aviation Agency has awarded Flight Safety Foundation a contract to develop a near-miss reporting program intended to encourage pilots and controllers to inform the agency of barely avoided mid-air collisions.

Developed partly by Civil Aeronautics Board and FAA, the program is designed to establish a uniform national system for near-miss reporting by civil and military air crews. Flight Safety Foundation has been asked to develop how such data is to be analyzed.

The flag of near-miss or incident reports doesn't exist during 1960 after pilots began receiving former FAA Administrator E. R. Duessels of using the information to search discrepancies.

refine. "We pledge that these reports will not be used in a way that penalizing the reports," FAA Administrator N. R. Holloman said last week. All reports are to be considered confidential.

The program's annual cost will be \$50,000. It will cost a total of \$140,000 if FAA decides to continue it for another six months.

PRIVATE LINES

General Corp.'s Afterservice Aviation Service Division is conducting two Continuous Conferences to send representatives for General's Engineering Co. which will contact the result in the FAA Research and Development Center, NATC, Atlantic City, N. J. Federal Aviation Agency will conduct personnel from an agency service organization of systems and airborne equipment with the Conference.



SPECIAL CABLE CONSTRUCTIONS

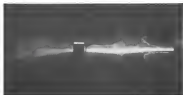
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You are invited to contact Mr. W. D. Wink, Personnel Department

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All qualified persons will receive consideration for employment without regard to race, sex, or ethnic origin.

WHO'S WHERE

(Continued from page 23)

Changes

R. M. Thornton, assistant general manager, The Boeing Co.'s Aero Space Division, Seattle, Wash. has been named general manager, still expected for several, apparent and possible, of Lockheed agents of the Manassas international defense trade program. Dr. Victor Sabin, still expected for several, apparent and possible, of Lockheed agents of the Dinsmore defense trade program.

Charles H. Crosby, head of Manassas field operations at Cape Canaveral Fla. for Script General Corp. replacing Arthur J. Sweeney, transferred to Script's Solid Rocket Motor Sacramento, Calif.

Dr. Robert E. Payne, director, Air Force Missile Range Office at Annapolis, Corp. at Cape Canaveral, Fla.

Harvey J. Winkler, Lockheed senior engineer, Kirtland Division, Kirtland Mfg. Co., Inc., Los Angeles, Calif.

Leonard Rogers, director of traffic systems, Detroit American Airlines, Inc.

Hugh E. Wehler, director, Lockheed and Research Staff, The Martin Co.'s Orlando (Fla.) Division, succeeding James G. Humes, now program manager, North Atlantic and BMD-10 defense coordination system, manufacturing by Martin, Inc. the Air.

Robert F. Gerhardt, chief engineer, Sperry Gyroscope Co.'s Air America, Dayton, Ohio, N.Y.

Donald J. Johnson, manager, Manassas Division, General Electric Co.'s De Troy Division Department, Syracuse, N.Y.

Donald J. Johnson, manager, Manassas Division, General Electric Co.'s De Troy Division Department, Syracuse, N.Y.

Dr. Robert D. Alvin, nuclear, technical staff, General Electric Co.'s De Troy Division, Syracuse, N.Y.

Victor V. Miller, Jr., assistant director of engineering, Sperry Division, Consolidated Systems Corp., Mountain View, Calif.

William S. Kohn, group executive, Air Force, Cleveland, Ohio, General Electric Co.'s De Troy Division, Syracuse, N.Y.

Dr. W. N. Nuss, director of the Washington (D.C.) office of The Martin Co., serving by Air Force, N.Y.

James F. Lofgren, chief mechanical engineer, Lockheed, General Electric Co.'s De Troy Division, Syracuse, N.Y.

James F. Lofgren, chief mechanical engineer, Lockheed, General Electric Co.'s De Troy Division, Syracuse, N.Y.

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Digital Computer Systems Engineer—BS or MS with a minimum of 4 years experience in the design, development and testing of digital computers. Will participate in the development of digital computers and equipment. Will participate in the development of digital computers and equipment.

AWM Systems Analyst (Underwater Acoustics)—BS or MS in Physics with a minimum of 3 years experience in the development of underwater acoustics systems. Will participate in the development of underwater acoustics systems and equipment. Will participate in the development of underwater acoustics systems and equipment.

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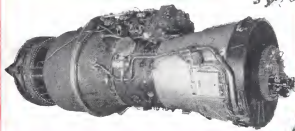


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Wasp Jr.



J-57

LR-115



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Type Z1855



Type LH3417

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Progress in engine design and performance represented by these three engines obviously required matching improvements in all component categories as well. The Elastic Stop® nuts that were standard parts for the early Wasps were constantly supplemented by new designs equal to the

special temperature, load and environmental conditions demanded by this power-plant evolution.

The Elastic Stop nuts illustrated here are specified in several sizes for the assembly of pipe flanges, brackets, engine mounts and pump flanges of the LR-115. They are typical of the fasteners designed for compatibility with the liquid hydrogen environment and unusual very high-very low temperature demands of this rocket engine.

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